

**Deposition of:**

Shahrokh Rouhani, Ph.D., P.E.

**Case:**

A.O.A., et al.

VS

DOE RUN RESOURCES CORPORATION , et al.,

**Date:**

4-14-2021



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Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021  
A.O.A., et al. vs DOE RUN RESOURCES CORPORATION , et al.,

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A.O.A., et al. vs DOE RUN RESOURCES CORPORATION , et al.,

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Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021  
A.O.A., et al. vs DOE RUN RESOURCES CORPORATION, et al.,

I N D E X  
SHAHROKH ROUHANI, PHD, PE  
April 14, 2021

EXAMINATION OF SHAHROKH ROUHANI, PHD, PE:

Examination by Ms. Wilkins 7

DEPOSITION EXHIBITS  
SHAHROKH ROUHANI, PHD, PE  
April 14, 2021

NUMBER	DESCRIPTION	MARKED
1	Supplemental Expert Report of Shahrokh Rouhani, Ph.D., P.E., dated March 19, 2021	8
2	2017 EPA Guidance	24
3	USEPA NAAQS Table	73
4	Meteorology and Atmospheric Physics article titled Air quality model performance evaluation, J.C. Chang and S.R. Hanna	137
	Errata	152
	Witness Signature	154

Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021  
A.O.A., et al. vs DOE RUN RESOURCES CORPORATION, et al.,

1 THE VIDEOGRAPHER: We are on the  
2 record at 8:57. Today's date is April 14,  
3 2021, and all parties are attending by Zoom  
4 videoconference. We are here today for the  
5 deposition of Dr. Shahrokh Rouhani to be taken  
6 in the case of A.O.A. versus Doe Run Resources  
7 Company, et al.

8 At this time would counsel identify  
9 themselves for the record, please?

10 MS. WILKINS: Beth Wilkins for the  
11 Plaintiffs.

12 MS. KRAFT: Kristine Kraft for the  
13 Plaintiffs.

14 MR. WILL: Robert Will for Defendant  
15 Doe Run Resources Corporation.

16 MR. BUTTERFIELD: Randy Butterfield  
17 for the Defendants.

18 THE VIDEOGRAPHER: Thank you. Would  
19 the court reporter please swear in the  
20 witness?

21

22 / / /

23

24

25

Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021  
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1                   SHAHROKH ROUHANI, Ph.D., PE,  
2  
3 of lawful age, having been first duly sworn to  
4 testify the truth, the whole truth, and nothing but  
5 the truth in the case aforesaid, deposes and says in  
6 reply to oral interrogatories propounded as follows,  
7 to-wit:

8                                   -----

9                                   EXAMINATION

10                                  -----

11 QUESTIONS BY MS. WILKINS:

12           Q.       Good morning, Dr. Rouhani.

13           A.       Good morning.

14           Q.       You understand that we are here today to  
15 take your deposition regarding a supplemental expert  
16 report that you prepared in this case; correct?

17           A.       Correct.

18           Q.       Okay. And I'm just going to -- if you  
19 recall when we -- we did this last time, we dropped  
20 exhibits into the Chat panel and you can download  
21 them from there.

22                   Do you recall that?

23           A.       Last time we had a face-to-face  
24 deposition.

25           Q.       That's right, we did.



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1 A. Yeah.

2 Q. I forgot about that. You were one of the  
3 last ones to get in.

4 So do you understand how to pull the  
5 exhibits from the Chat panel?

6 A. I believe so.

7 (Deposition Exhibit 1 marked  
8 for identification.)

9 QUESTIONS BY MS. WILKINS:

10 Q. Okay. So I'm going to drop a copy of  
11 your report marked as Exhibit 1 into the Chat panel.  
12 Can you let me know when you receive that?

13 A. I have -- I just downloaded that. It's  
14 on my machine now.

15 Q. Okay. Can you take a look at that and  
16 confirm for me that that is the supplemental expert  
17 report that you prepared in this case?

18 A. Sure. I confirm that it seems to be my  
19 expert report, yes.

20 Q. As of right now, are there any changes  
21 that need to be made to your report?

22 A. Not that I know of.

23 Q. Last week -- approximately last week  
24 there was a file produced to my office with your  
25 reliance materials. It contained two Excel

1 spreadsheets, an RND file, and a 1978 EPA guideline  
2 on air quality models.

3 Do you have any additional documents that  
4 you're relying on aside from those materials and the  
5 ones that are cited in your supplemental report?

6 A. I don't think so.

7 Q. Okay. Do you have any files or documents  
8 with you today that have not already been provided  
9 to my office?

10 A. I don't think so.

11 Q. Okay. So during your last deposition  
12 about a year ago, you testified that air modeling is  
13 not your field of expertise. Is that still true?

14 A. Correct.

15 Q. And you testified that you had never  
16 performed a peer review of any air modeling article.  
17 Is that still true?

18 A. Correct.

19 Q. You testified before that you have never  
20 taught any classes in air modeling. Is that still  
21 true?

22 A. Correct.

23 Q. And you testified previously that, within  
24 your company, you do not advertise yourself as  
25 providing air modeling services to clients. Has

1 that changed?

2 A. Correct.

3 Q. I'm sorry, there was some background  
4 noise. Did you say correct?

5 A. Yes.

6 Q. Okay. Other than maybe having done some  
7 air modeling in graduate school, you previously  
8 testified that you have not performed air modeling  
9 in your career. Is that still accurate?

10 A. As is stated in my CV, I have done  
11 research on air modeling in the past for EPA. So in  
12 addition to those that I did in grad -- during my  
13 graduate studies, I also conducted air modeling for  
14 EPA years ago.

15 Q. So you -- you conducted the air modeling,  
16 created the air model yourself. Is that what you're  
17 telling me now?

18 A. I believe so. It's all stated in my CV,  
19 which is part of my expert report. If you go to --  
20 it was in my original report that contained my CV  
21 and part of that was the -- some -- the air modeling  
22 investigation that I did years ago.

23 Q. And how many years ago was that?

24 A. I would say that it was roughly 25 years  
25 ago. I was still at Georgia Tech.

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1 Q. Okay. And that was during graduate  
2 school?

3 A. No, that was during the time that I was a  
4 faculty, tenured faculty, at Georgia Tech.

5 Q. Okay. You are not trained to run  
6 CALPUFF, are you?

7 A. No.

8 Q. And you're not trained to understand the  
9 results of CALPUFF?

10 MR. WILL: Object to form. Vague.

11 THE WITNESS: I was not trained to  
12 use CALPUFF.

13 QUESTIONS BY MS. WILKINS:

14 Q. In your deposition a little over a year  
15 ago, you testified that, in your career, you've  
16 never applied EPA air modeling protocols in your  
17 work. Is that still accurate?

18 A. Do you mean CALPUFF?

19 Q. No, I'm talking about the EPA protocols  
20 that advise how to perform air modeling.

21 A. I'm very --

22 MR. WILL: Object to form. Vague.

23 THE WITNESS: I'm very familiar with  
24 those -- with those -- the guidance document  
25 and I've cited them both in my original expert

1 report as well as in my supplemental report.

2 QUESTIONS BY MS. WILKINS:

3 Q. Aside from in this case, have you ever  
4 applied the type of statistical analysis that you're  
5 doing here to an air model in -- in any other time  
6 in your career?

7 A. If -- if you mean that comparison of  
8 predicted value versus measured value, that's a  
9 standard procedure that I -- that I've used in air  
10 modeling work that I did while I was at Georgia  
11 Tech.

12 Q. While you were at Georgia Tech, did you  
13 compare in time and space predicted values from an  
14 air model to measured values?

15 A. Correct.

16 Q. Do you hold yourself out to have an  
17 expertise in air quality modeling?

18 A. No.

19 Q. Do you have expertise in the collection  
20 of the measured air quality data used in air  
21 modeling?

22 A. Can you clarify your question? What do  
23 you -- do you mean the actual measurement  
24 techniques?

25 Q. Well, we'll ask you that. Do you have --

1 A. Okay.

2 Q. -- expertise in the measurement  
3 techniques for collecting air quality data that's  
4 used in air quality models?

5 A. No.

6 Q. Do you have expertise in determining  
7 whether measured air concentrations used in air  
8 quality models accurately reflects the air  
9 concentrations where they were collected?

10 A. If you mean that by quantitative  
11 assessment of a model, yes.

12 Q. No, what I'm asking you is, do you have  
13 any expertise in determining whether the data that  
14 you get from an air monitor is accurate?

15 A. When -- let me put it this way. By -- my  
16 expertise is on environmental statistics and I am  
17 validating -- or evaluating a model by comparing its  
18 predicted values to measured values. Within that  
19 context, I'm very much an expert.

20 Q. So my question is about specifically the  
21 data that's collected from the air monitors. Are  
22 you an expert in evaluating whether air monitors are  
23 accurately reporting the air concentrations in the  
24 location where they are sited?

25 A. I'm not an expert in air monitoring

1 techniques.

2 Q. Do you consider yourself to have  
3 expertise in evaluating whether the meteorological  
4 data that's used in an air model is of good quality?

5 A. I'm not an expert in the reliability of  
6 meteorological data.

7 Q. Would you agree that when you are  
8 evaluating an air quality model's accuracy, you need  
9 to consider what is known about the environment  
10 that's being modeled?

11 A. That's the job of the modeler to ensure  
12 the reliability of his or her model results. Every  
13 relevant condition must be considered.

14 Q. My question is you, Dr. Rouhani, when you  
15 are evaluating an air quality model's accuracy, like  
16 you've done in this case, is it important for you,  
17 Dr. Rouhani, to consider what's known about the  
18 environment that's being modeled?

19 And I'm sorry, I mispronounced your name.

20 A. Rouhani, that's okay.

21 I believe that I've -- when you are  
22 evaluating a model, the premise is that the modeler  
23 has done his job correctly, and therefore, the  
24 results that he presents as a predicted value is  
25 the -- is based on adequate knowledge of the site

1 conditions. Within that context, then you can  
2 compare those predicted values to measured values,  
3 or other alternative models, to assess the stated  
4 conclusions.

5 Q. So let me make sure I understand your  
6 testimony. Is it your testimony that when you,  
7 Dr. Rouhani, are evaluating an air quality model,  
8 you trust that the modeler has considered what's  
9 known about the environment that's being modeled,  
10 and therefore you don't need to consider that  
11 yourself; is that accurate?

12 MR. WILL: Object to form.

13 THE WITNESS: Obviously, you know,  
14 like similar to this case, when I was  
15 reviewing that, I got myself acquainted with  
16 the terrain and history of the site, but I am  
17 generally assuming that the modeler has done  
18 his job adequately and is representing the  
19 most reliable predictions that he or she can  
20 generate. This is when I come in and then  
21 compare those to the measured values.

22 QUESTIONS BY MS. WILKINS:

23 Q. So is it important for you, Dr. Rouhani,  
24 to know when you are evaluating an air quality  
25 model, the geography of the area that's being



1 modeled?

2 A. I made myself familiar with both the  
3 geography, topography, and history of the site.

4 Q. Is it important to you when you are  
5 evaluating an air quality model to consider whether  
6 there's a large emission source, like a smelter, in  
7 the area?

8 A. I mean, the history of the site is always  
9 important. And I've made myself familiar with the  
10 historical conditions at this site, including the  
11 presence of a larger meteorologic -- I'm sorry,  
12 mineralogical complex.

13 Q. Metallurgical complex I think is the word  
14 you were looking for.

15 A. Yes, that's right. That's correct.

16 Q. Sure. Is it important to you, when you  
17 are evaluating an air quality model, to understand  
18 whether blood lead levels have been high in the  
19 community that's being modeled?

20 A. In this case, I focused on -- in my  
21 supplementary work, on Mr. Sullivan's modeling  
22 results, and I -- and I don't believe that he -- he  
23 got to the level of blood lead levels. So in this  
24 case, I focused basically on predicted results that  
25 Mr. Sullivan has provided versus those as measured.

1 Q. So is it your testimony that here it was  
2 not important for you to consider what the blood  
3 lead levels have been in the community?

4 A. For this -- for the opinions expressed in  
5 my supplementary report, I don't believe that they  
6 were -- that they were a critical element.

7 Q. Is it important, when you are evaluating  
8 an air model's accuracy, for you to consider the  
9 siting of air monitoring stations?

10 A. The monitoring stations are the source of  
11 the observed measured values and therefore I believe  
12 that their sitings are important.

13 Q. What is important for you to understand  
14 about the siting of the air monitoring stations?

15 A. In this case, the result is that if those  
16 measurements are treated as reliable or not.

17 Q. And so what do you evaluate about the air  
18 monitoring stations to consider whether or not the  
19 measurements they're making are reliable?

20 A. If the measurements are presented as --  
21 as measured values, or observed values, then I'm  
22 assuming that, when I'm comparing the predicted  
23 values to those, that they are reliable.

24 Q. So you're not independently doing  
25 anything to determine whether the information

1 collected from the air monitoring stations is  
2 reliable; is that correct?

3 A. Correct, I am not evaluating the  
4 reliability of measurement values. I am totally  
5 relying on Mr. Sullivan's reported measured values.

6 Q. And you are not considering whether the  
7 air monitoring stations are properly sited to  
8 collect accurate information; is that correct?

9 A. I'm not assessing the -- the issues  
10 related to the siting of the measurement stations,  
11 correct.

12 Q. When you are evaluating an air model  
13 where the model is designed to determine human  
14 health risks or impacts, is it important for you to  
15 consider where people live within the vicinity of  
16 the source of exposure?

17 A. Again, I'm assuming that the modeler is  
18 covering critical areas from -- to cover various  
19 issues of concerns, including the population  
20 centers.

21 Q. During your last deposition you testified  
22 that you had never been to La Oroya. I assume  
23 that's still true?

24 A. True.

25 Q. So you have not seen the geography of

1 La Oroya in person.

2 A. I've not seen the geography in person.

3 Q. Are you aware that there are seven  
4 monitoring stations from which the data was  
5 collected and used for air modeling in this case?

6 A. I'm aware of those.

7 Q. Are you familiar with the Huanchan site?

8 A. I believe so.

9 Q. What do you know about that site?

10 A. Huanchan is located to the east of the  
11 La Oroya Antigua and I believe that it is mainly a  
12 waste disposal area based on the pictures that I've  
13 seen. If I'm not wrong, Huanchan was a major place  
14 where they stored waste.

15 Q. Can you describe the geography of the  
16 Huanchan site?

17 A. Again, I'm relying on my memory. It is  
18 located to the east of the city along the valley  
19 where the river flows and it is -- I don't believe  
20 that it's that far from La Oroya Antigua.

21 Q. So you'd describe the geography as being  
22 a valley. Would you agree that it's a rather narrow  
23 valley where the Huanchan site is located?

24 A. I'm not an expert in -- in topography,  
25 but based on the pictures that I saw, they look like

1 a fairly narrow valley.

2 Q. And would you agree that the waste pile  
3 at Huanchan is located on a small plateau that's on  
4 a hillside? Are you aware of that?

5 A. The Google pictures depict something of  
6 that nature, yes.

7 Q. Is it important for you to consider that  
8 geography when you are evaluating air modeling of  
9 the Huanchan site?

10 A. I'm assuming that the modeler has  
11 considered those specific topographical features in  
12 their modeling results.

13 Q. Do you know how close any -- the people  
14 within La Oroya live to the Huanchan site?

15 A. In the Google pictures, you could see  
16 only a few people walking around the area where  
17 Huanchan is, far less than the number of people that  
18 you see in pictures from La Oroya Antigua.

19 Q. Did you see any houses nearby the  
20 Huanchan site?

21 A. I don't recall any.

22 Q. Do you recall any schools or commercial  
23 businesses of any kind near the Huanchan site?

24 A. I don't remember seeing any of that.

25 Q. Do you have any opinion as to whether an

1 air quality model can accurately represent or  
2 predict air quality around the Huanchan site?

3 A. I have not looked into that question at  
4 all.

5 MS. WILKINS: And if I can just say  
6 quick, I'm not --

7 THE WITNESS: Yes.

8 MS. WILKINS: -- sure who it might  
9 be, but somebody has e-mail alerts on, I  
10 believe, and they're a little bit distracting.  
11 So if it's possible to turn those off, I'd  
12 appreciate that.

13 QUESTIONS BY MS. WILKINS:

14 Q. Do you understand what model calibration  
15 means with regard to air quality model -- modeling?

16 A. Yes, in general terms.

17 Q. And what do you understand -- I'm sorry,  
18 what do you understand that to mean?

19 A. I understand it is usually referred to a  
20 broad range of computational activities where the  
21 model results are compared to the measured values,  
22 and to the extent possible, adjustments are done to  
23 improve the reliability of the model, i.e., bring  
24 them as close as possible to the measured values.

25 Q. Is it your opinion that model calibration

1 is an accepted method in the U.S. for air quality  
2 modeling methodology?

3 A. When there is plenty of -- when -- let me  
4 say -- start again.

5 In fact, when there are ample data  
6 observed, measured values, then calibration is  
7 almost a generic part of any modeling activity.

8 Q. Does the USEPA advise that model  
9 calibration should be done in air modeling?

10 A. I don't believe that they have any broad  
11 recommendations about it. However, when data is  
12 available, when the -- when the concept is  
13 simulation of a historic condition, calibration is  
14 always conducted by model makers.

15 In certain cases, especially when you are  
16 dealing with regulatory or hypothetical future  
17 conditions, calibration may not be feasible and thus  
18 may not be recommended, but those are generally for  
19 regulatory conditions when hypothetical conditions  
20 are being considered in the future.

21 Q. Do you have any authority that you can  
22 cite that supports that -- your opinion that  
23 calibration is almost always a generic part of any  
24 modeling activity?

25 A. If --

1 MR. WILL: Object to form.

2 THE WITNESS: If the objective of the  
3 modeling activity simulate past historical  
4 conditions, and if measured values are  
5 available, it's a generic part of the method.  
6 Many of the earlier EPA guidance documents, in  
7 fact, you know, talk about it. They talk  
8 about that reliability of a model is measured  
9 in specific terms, therefore, only in  
10 hypothetical future regulatory conditions,  
11 that I am aware of, that calibration is not --  
12 is not -- is not recommended.

13 QUESTIONS BY MS. WILKINS:

14 Q. And my question is, do you have any  
15 authority that you can -- authority that you can  
16 cite to that supports your opinion that if the  
17 objective of the modeling activity is to simulate  
18 past historical conditions, then it's a generic part  
19 of the methodology? Is there any authority that you  
20 can point me to that supports that opinion?

21 A. I believe that if you look at and read  
22 the cited EPA guidance document that, in fact,  
23 Mr. Sullivan has included in his reliance documents,  
24 you can easily find references that clearly point to  
25 the need or the desire to -- I'm sorry, the



1 preference for calibration, especially when a large  
2 amount of measured values are available.

3 Q. Which guidance document from the EPA are  
4 you referring to there?

5 A. For example, I'm thinking about the --  
6 you know, the earliest one. I believe it was 1978.  
7 Then there's 2017. There are -- you know, there are  
8 numerous guidance documents that, in fact, very  
9 clearly point to the need for calibration if  
10 measured data are available and if our goal is to  
11 simulate past historical conditions.

12 (Deposition Exhibit 2 marked  
13 for identification.)

14 QUESTIONS BY MS. WILKINS:

15 Q. I'm going to mark a copy of the 2017 EPA  
16 guidance as Exhibit 2. I'll put it in the Chat  
17 panel and I would like you to point me where in that  
18 document it advises about the need for calibration  
19 if measured data are available and if the goal is to  
20 simulate past historical conditions. So if you can  
21 just give me a second to get that marked and into  
22 the Chat box.

23 MS. WILKINS: It's not cooperating.

24 Okay. Gretta, I'm not able to mark  
25 this document because it's a locked PDF. Are

1           you able to do that on your end?

2                   THE COURT REPORTER: If they are  
3           locked, I don't think I can either, but you're  
4           welcome to put it up there and I can maybe try  
5           and mark it on a break.

6                   MS. WILKINS: Okay.

7                   THE COURT REPORTER: Either way, if  
8           you identify it, we can get it marked.

9                   MS. WILKINS: Okay. Thanks.

10                  THE COURT REPORTER: Sure.

11       QUESTIONS BY MS. WILKINS:

12           Q.       I put that in the Chat panel,  
13       Dr. Rouhani, if you can let me know when you're able  
14       to see it.

15           A.       Sure. Okay. I have it.

16           Q.       So this document that I've just shared  
17       with you that we'll refer to as Exhibit 2, is this  
18       the 2017 EPA guidance on air quality models that you  
19       were referring to?

20           A.       This is the revision to the guidelines on  
21       air quality models. And it's enhancement to the  
22       air -- AERMOD dispersion model and incorporation of  
23       approaches to address ozone and fine particulate  
24       matters.

25           Q.       And is this the -- the referenced

1 document that you were referring to when you said  
2 that Mr. Sullivan had included some references on  
3 the preference for calibration?

4 A. Mr. Sullivan refers to a plus or minus  
5 factor of 2. I believe that he refers to it and  
6 it's an EPA 2008 document, based on my memory, which  
7 is -- I cited that in my original document.

8 Q. Okay. I'm not talking about the factor  
9 of 2 or anything of that nature.

10 What I'm asking you about is your  
11 testimony that there's a 2017 EPA document that  
12 advises for the need for calibration if measured  
13 data are available and if our goal is to simulate  
14 past historical conditions. Is this the 2017  
15 document that you were referring to?

16 A. I don't believe that this document  
17 specifically refer to -- to the need for  
18 calibration. It's a general accepted concept among  
19 modelers that if you are simulating historical  
20 conditions, and if there are ample air modeling  
21 measurements available, calibration is a generic  
22 part of the modeling activities.

23 Q. Okay. Your expert supplemental report in  
24 this case cites a number of reference materials;  
25 correct?

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1 A. Yes.

2 Q. Can you point to any of those reference  
3 materials that supports that if you're simulating  
4 historical conditions and ample air modeling  
5 measurements are available, that calibration is a  
6 generic part of the modeling activities?

7 A. I'm now searching for that statement  
8 because, if you allow me, I will go over to Exhibit  
9 No. 1 and tell you.

10 For example -- for example, if you look  
11 at paragraph 18 of my supplemental report, it states  
12 that, The results of any air model should be  
13 assessed against measured values to determine its  
14 reliability.

15 And then I cite the USEPA 1978,  
16 Section 6, page 39, which states that, Any  
17 application of air quality models may have  
18 deficiencies which cause estimated concentrations to  
19 be in error. When practical to obtain a measure of  
20 confidence in the estimate, they should be compared  
21 with observed air quality and their validity  
22 determined.

23 So I am -- these are the type of  
24 statements that EPA has made which implies that --  
25 that you need to compare -- if there are measured

1 values available, compare your predicted values to  
2 measured values, and then -- which makes it a  
3 generic part of -- of a modeling process.

4           So that is my interpretation that -- and  
5 based on my experience, calibration in those cases  
6 are a generic part of the estimation process.

7           Q.     And the experience that you're  
8 referencing there, is that your experience 25 or so  
9 years ago creating an air model?

10          A.     It is -- covers a lot longer, in a 40,  
11 50 year -- not 50 years, but almost -- more than  
12 40 years of experience in environmental modeling.

13          Q.     And how many times in your career have  
14 you actually performed calibration on an air model  
15 that you created?

16          A.     As I mentioned it, my air modeling goes  
17 back to my Georgia Tech days when I did for EPA.

18          Q.     And my question is, how many times in  
19 your career have you actually performed calibration  
20 on an air model that you created?

21          A.     As I said, my experience goes back to my  
22 Georgia Tech days when I conducted that modeling  
23 activity for USEPA.

24          Q.     And what I'm asking you is how many  
25 times? Not when or where. How many times?

1           A.       Times? I mean, calibration is not  
2 something that you can count it as 1, 2, 3, 4 times.  
3 You -- when you present a model as part of this  
4 generic development, a calibration is involved. And  
5 it's usually, a lot of times, is an involved  
6 process. So it's not a one-time step. You adjust  
7 certain parameters and see how the model is doing.  
8 You go through many iterations until you reach a  
9 model that you view as being reliable.

10          Q.       How many models have you performed  
11 calibration on that you have created?

12          A.       I mean, it's really many. I -- I cannot  
13 even count it. Only -- probably my CV would be the  
14 best indication of that.

15          Q.       Okay. I'm asking you about models that  
16 you, Dr. Rouhani, air models that you have created.

17          A.       Oh, air models.

18          Q.       How many of those have you performed  
19 model calibration on?

20          A.       Every time -- you know, as I said, I did  
21 that work with USEPA when I was at Georgia Tech. I  
22 also did another air modeling for Atlanta, and this  
23 was, I remember it, it was in 1996. It was as part  
24 of the Olympic activity. And each time, calibration  
25 was a generic part of my procedure.

1 Q. So are we talking about two air models?

2 A. Two projects that involved air modeling.

3 Q. Is it your opinion that the EPA advises  
4 that model calibration should be performed to  
5 evaluate the performance of an air model?

6 A. The performance of a model depends on the  
7 objectives of the activity. If, for example -- EPA,  
8 in fact, is quite clear about it -- if the modeling  
9 is being done for regulatory purposes under  
10 hypothetical -- future hypothetical conditions,  
11 calibration frankly is not feasible. You don't have  
12 any data to -- future data to compare it to.

13 But if the objective is to simulate  
14 historical conditions and if measurements are  
15 available, calibration is a generic part of -- of  
16 any air modeling, of such air modeling activities.

17 Q. So my question was, is it your opinion  
18 that the EPA advises that model calibrations should  
19 be performed to evaluate the performance of an air  
20 model?

21 MR. WILL: Object to form.

22 QUESTIONS BY MS. WILKINS:

23 Q. Does the EPA do that?

24 MR. WILL: Object to form. Asked and  
25 answered.

1 THE WITNESS: As I said before, if  
2 the objective is regulatory applications under  
3 hypothetical future conditions, I don't  
4 believe that calibration is warranted. But if  
5 it's the simulation of past historical  
6 results, and ample data are available, then  
7 calibration is -- is a generic part of the  
8 modeling process.

9 QUESTIONS BY MS. WILKINS:

10 Q. So is it your testimony that the EPA  
11 advises that model calibration should be performed  
12 to evaluate the performance of an air model if the  
13 air model is attempting to simulate past historical  
14 results and ample data are available?

15 A. This is my understanding of the  
16 statements that are embedded in various EPA guidance  
17 documents.

18 Q. Okay. And one of those EPA guidance  
19 documents that you're referring to is the 1978  
20 document; correct?

21 A. One of them, yes.

22 Q. And what other EPA guidance documents are  
23 you referring to for your understanding that the EPA  
24 advises that model calibration should be performed  
25 to evaluate the performance of an air model if the



1 air model is attempting to simulate past historical  
2 results and ample data are available?

3 A. I believe that Mr. Sullivan cites EPA  
4 2008. That's another one that, again, talks about  
5 comparing predicted values to measured values.

6 And --

7 Q. Do you -- go ahead.

8 A. I'm sorry.

9 Q. No, I'm sorry. Go ahead.

10 A. And that's where the statement plus or  
11 minus to factor of -- plus or minus factor of 2, in  
12 fact, was cited by Mr. Sullivan. In 2017, on  
13 page 5000 -- again, as I stated in my supplemental  
14 report, paragraph 19, As noted in USEPA 2017,  
15 page 5209, errors in model input can result in  
16 concentration error -- errors. Such  
17 uncertainties -- this is a quotation -- do not  
18 indicate that an estimated concentration does not  
19 occur, only the precise time and locations are in --  
20 in doubt. Composite errors in highest estimated  
21 concentrations of 10 to 40 percent are found to be  
22 typical.

23 So you immediately see that. When an EPA  
24 guidance document talks about errors, i.e., the  
25 difference between predicted values and measured

1 values, and it even puts a bound on what are those  
2 typical errors could be, then it clearly means that  
3 calibration is a generic part of the process.

4 Q. We're talking about model calibration.  
5 Let me make sure we're talking about the same thing.

6 Is it your opinion that the EPA advises,  
7 in this 2017 document, that model performance should  
8 be evaluated by comparing specific hourly measured  
9 data points taken at a specific location to the  
10 value that the model predicts at that time and  
11 location?

12 A. In fact, the 2017, as, again, I have  
13 mentioned in my supplementary report, states that.  
14 And this is a direct quotation of that on page 5209.  
15 Such uncertainties do not indicate that an estimated  
16 concentration does not occur, only that the precise  
17 time and locations are in -- therefore --

18 THE COURT REPORTER: I'm sorry,  
19 Doctor, I couldn't -- I didn't hear the last  
20 part. You said "precise time and locations  
21 are" something.

22 THE WITNESS: In doubt.

23 THE COURT REPORTER: Oh, thank you.

24 THE WITNESS: I'm sorry, do you hear  
25 me well now?

1 THE COURT REPORTER: No, I did, I  
2 just didn't hear the last two words.

3 THE WITNESS: Okay. Sorry.

4 So again, it is my understanding that  
5 this EPA guidance document still would like to  
6 perform a degree of calibration but not  
7 necessarily in a precise time and location.  
8 That's the reason that I have conducted  
9 nonconcurrent comparisons to just make sure  
10 that maybe, on a nonconcurrent basis, the  
11 results are -- again, can be viewed as  
12 reliable and close to those measured.

13 QUESTIONS BY MS. WILKINS:

14 Q. Okay. In your supplemental expert  
15 report, part of what you did was to compare a  
16 specific measurement taken at a specific time at a  
17 specific location to the -- what the model predicts  
18 to be the air concentrations at that time and  
19 location; correct?

20 A. Those are what I refer to as concurrent  
21 comparisons, yes.

22 Q. Do you agree that the EPA says that  
23 should not be done to evaluate model performance?

24 A. I have not seen any statements saying  
25 that concurrent comparisons should not be that.

1 However, when you are using models, USEPA 2017 gives  
2 you -- allows you to also consider nonconcurrent  
3 comparisons. And I have looked at those separately,  
4 also.

5 Q. Okay. You cited the EPA 2017 document,  
6 page 5209. Can you go to that page, please? It's  
7 page 28 of the PDF, if that's helpful.

8 A. Sure.

9 Q. Let me know when you're there, please.

10 A. Sure. I'm getting there. Okay. I'm  
11 there.

12 Q. Okay. Do you see in the middle column of  
13 that page, Section 4.2?

14 A. I was in the wrong page, sorry.

15 Okay. Now I'm there, 4.2, yes.

16 Q. Okay. And just for the record, this is a  
17 document that we will be marking as Exhibit 2.

18 Right above Section 4.2, do you see the  
19 last section -- or the last sentence of Section 4.1  
20 that reads, Because of the uncertainty in paired  
21 modeled and observed concentrations, any attempts at  
22 calibration of models based on these comparisons is  
23 of questionable benefit and shall not be done.

24 Do you see that?

25 A. Yes.

1 Q. Okay. Do you understand that to -- when  
2 it references paired modeled and observed  
3 concentrations, what it's talking about is comparing  
4 a measured value taken at a specific time and  
5 location to the modeled prediction at that time and  
6 location?

7 MR. WILL: Object to form.  
8 Mischaracterizes the document.

9 THE WITNESS: In fact, if you look at  
10 this document, this section that you sited,  
11 it's about models for carbon monoxide, lead,  
12 sulfur, and primary particulate matters.  
13 That's Section 4.0.

14 And this particular one, it is for  
15 the case of model evaluation intercomparison  
16 should -- when you are considering regulatory  
17 conditions and, therefore, hypothetical future  
18 conditions are the ultimate objective of the  
19 model. In those cases, I -- my understanding  
20 is that EPA is saying that calibration will  
21 not be -- is of questionable benefit and shall  
22 not be done.

23 QUESTIONS BY MS. WILKINS:

24 Q. But isn't that what you did in your  
25 concurrent comparison section?

1           A.       This is, in fact, related. The statement  
2 in the EPA guidance document is it really involves  
3 about the cases where you are using the model as for  
4 regulatory basis on the future hypothetical  
5 conditions.

6                   The case --

7           Q.       All right. Let me --

8           A.       The case at hand -- I'm sorry. The case  
9 at hand, on the other hand, is the simulation of  
10 past historical condition where, in my opinion,  
11 there is ample data available at multiple stations  
12 that can be used to assess the reliability of the  
13 model.

14          Q.       What is this document talking about in  
15 this sentence we just read, when it references  
16 observed concentrations?

17                   MR. WILL: Objection. Asked and  
18 answered.

19                   THE WITNESS: When it -- you know,  
20 imagine that if the model is intended to be  
21 for -- to be used for regulatory purposes for  
22 hypothetical future conditions. In those  
23 cases, calibration is -- according to the EPA,  
24 is of questionable benefit and shall not be  
25 done. And it does not talk about a model that

1 is specifically designed to simulate past  
2 historical conditions when there is ample  
3 data. In those cases, the reliability of that  
4 model can easily be compared either using  
5 nonconcurrent comparisons or concurrent  
6 comparisons.

7 MS. WILKINS: I'm going to move  
8 that -- to strike that response as  
9 non-responsive.

10 QUESTIONS BY MS. WILKINS:

11 Q. My question is, in this sentence that we  
12 read which states, Because of the uncertainty in  
13 paired modeled and observed concentrations, any  
14 attempts at calibration of the models based on these  
15 comparisons is of questionable benefit and shall not  
16 be done; what do you understand the EPA to be  
17 referring to when they say, "observed  
18 concentrations?" That's my whole question. What is  
19 the EPA referring to when they say "observed  
20 concentrations?"

21 MR. WILL: Object to form. Asked and  
22 answered.

23 THE WITNESS: If you'd like, let's  
24 start with this paragraph. It starts by  
25 saying model evaluations and inter-comparisons

1           should take --

2       QUESTIONS BY MS. WILKINS:

3           Q.       This is not my question. That is not my  
4       question.

5                   What is the EPA referring to when they  
6       say "observed concentrations?"

7           A.       If you allow me, I'm trying to answer  
8       your question. You are putting one word out of  
9       context and I'm trying to put it back into the  
10      context that EPA is presenting in this document.

11          Q.       Let me ask you the question a different  
12      way.

13                   When the EPA is referring to observed  
14      concentrations here, are they talking about  
15      concentrations of substances in the air that are  
16      collected from air monitors?

17          A.       So the word "observed value" in this --  
18      in your question is directly described within the  
19      context of the paragraph that you are citing. It  
20      says, For a regulatory application of a model, the  
21      emphasis of the model evaluations is generally  
22      placed on the highest modeled impacts.

23                   Within that context of comparison of  
24      observed values to the modeled results, especially  
25      if you're -- because you're using the model for



1 regulatory applications and hypothetical future  
2 conditions, then calibration, there, EPA states, is  
3 of questionable benefit.

4               So the word "observed" is referred to the  
5 measurements that have been done in the past and  
6 they're saying that since this -- the model is  
7 intended for a regulatory application, which is an  
8 application that is happening in the -- under future  
9 hypothetical conditions, in those cases, calibration  
10 may be of questionable benefit and shall not be  
11 done.

12               So it is a different case that -- at  
13 hand. Here we have a case where the modeler clearly  
14 is attempting to simulate past historical results  
15 where ample observed values are measured.

16               MS. WILKINS: Move to strike as  
17 non-responsive.

18 QUESTIONS BY MS. WILKINS:

19           Q.     Do you agree that the EPA was --  
20 referring to observed concentrations, is referring  
21 to the measured data that is used to create the air  
22 model?

23               MR. WILL: Object to form.

24               THE WITNESS: I don't know at this  
25 point --

1 QUESTIONS BY MS. WILKINS:

2 Q. It's a yes or no question.

3 A. Again, within the consist of a  
4 regulatory -- regulatory application, an observed  
5 value is a measured value which was done in the  
6 past, but the model application is intended for  
7 extreme hypothetical conditions in the future. In  
8 those cases, EPA believes that calibrating the model  
9 to some past measurements which may not be  
10 representative of extreme hypothetical future  
11 conditions, is of questionable benefit and shall not  
12 be done. So I believe that --

13 Q. And my question --

14 A. -- I've answered your questions very  
15 clearly.

16 Q. No, you haven't.

17 Is the EPA referring here, when it talks  
18 about observed concentrations, to the actual  
19 measured air concentrations that are used in  
20 creating the model? Is that --

21 MR. WILL: I'm going to object -- I'm  
22 going to object to the question. It is -- to  
23 form. You've not laid a foundation that you  
24 use measured data to create air models.

25 MS. WILKINS: Okay. Let's lay the

1 form, then -- foundation, I mean.

2 QUESTIONS BY MS. WILKINS:

3 Q. Dr. Rouhani, is it your understanding  
4 that the EPA here, in this last sentence of  
5 Section 4.1, is referring to an air model that uses  
6 measured air quality data to create the model?

7 MR. WILL: Object to form.

8 Mischaracterizes the document.

9 THE WITNESS: I don't see that.

10 Basically it talks about models which are  
11 intended to be used in regulatory  
12 applications. The observed value  
13 concentrations could be any measurements which  
14 are clearly made in the past, while the model  
15 is intended to be used under -- according to  
16 this paragraph, very clearly are intended to  
17 be used for hypothetical extreme future  
18 conditions.

19 QUESTIONS BY MS. WILKINS:

20 Q. So what is your understanding of where a  
21 model designed to predict future gets its data?  
22 Where does it pull data from to create that model?

23 MR. WILL: Object to form. Lack of  
24 foundation.

25 THE WITNESS: When you're looking at

1 future hypothetical extreme conditions, which  
2 is the regulatory application of a model, you  
3 may use a variety of sources of information to  
4 construct your model. Observed measurements,  
5 if they are representative, or if you believe  
6 that they are -- they are, reasonable  
7 representation of the future hypothetical  
8 conditions will be used in the model  
9 developed; but if they're not, they will be  
10 not used.

11 And here, the EPA is reminding the  
12 users that if you are looking for those kind  
13 of future hypothetical extreme conditions,  
14 calibration may be of questionable benefit and  
15 shall not be done.

16 QUESTIONS BY MS. WILKINS:

17 Q. But it's your opinion it's okay to do it  
18 if you are looking at historical conditions?

19 A. If the objective of your model is to  
20 simulate past historical conditions and there are  
21 measured -- ample measurements available, definitely  
22 you should do that. Just even if you don't want to  
23 calibrate your model, you need to demonstrate that  
24 your model is reliable.

25 Q. And it's your opinion that the EPA

1 advises to do that in the 1978 document; right?

2       A.       The sheer fact that they talk about  
3 errors, and even in this model, in the previous  
4 paragraph 4.1e, kind of like towards the end of that  
5 paragraph, if, in fact, the sheer fact that it talks  
6 about composite errors in highest estimated  
7 concentrations of 10 to 40 percent are found to be  
8 typical, the sheer fact that they talk about even  
9 error means that -- that very much comparison of  
10 measured and observed values are a generic part of  
11 any modeling activity.

12       Q.       Where does it tell you in this section  
13 that you should compare a specific measured air  
14 concentration taken at a specific time, at a  
15 specific location, to the modeled value for that  
16 time and location, in order to evaluate the model's  
17 performance? Where does it tell you that?

18               MR. WILL: I'm going to object to  
19 form. Are you talking about Section 4.1 on  
20 page 5209?

21               MS. WILKINS: I'm talking about the  
22 whole document but Dr. Rouhani referred to  
23 this section at the bottom of 4.1e. He can  
24 tell me in that section where it refers --  
25 where that guidance is given, or the whole

1 document. I just want to know where the EPA  
2 says that you should do that.

3 MR. WILL: Well, I'm going to object  
4 to form as lack of foundation that this is  
5 even a document that addresses the issue.

6 THE WITNESS: It is my understanding  
7 that the sheer fact that the document talks  
8 about composite errors and what is composite  
9 error, the difference between measured and  
10 observed values -- I'm sorry, measured and  
11 predicted values implies that -- that you are  
12 supposed to do all those calculations,  
13 especially in a case which you are simulating  
14 past historical conditions.

15 QUESTIONS BY MS. WILKINS:

16 Q. So it's your opinion that because this  
17 document talks about composite errors, that -- the  
18 difference between measured and observed values,  
19 that when you are simulating past historical  
20 conditions, you should compare a specific  
21 measurement that was taken at a specific location at  
22 a specific time to the modeled value at that time  
23 and location in order to determine the model's  
24 performance?

25 MR. WILL: Object to form. Asked and

1 answered.

2 THE WITNESS: I -- I believe that you  
3 made a mistake. The error is the difference  
4 between measured and predicted value. And  
5 assuming that the sheer fact that this  
6 document talks about that, it means that  
7 comparisons need to be done and it even  
8 defines the range of margins of error which  
9 typically occur.

10 QUESTIONS BY MS. WILKINS:

11 Q. So is it your opinion that this  
12 Section 4.1e tells you, Dr. Rouhani, that when you  
13 are evaluating the performance of an air model that  
14 is used to look at historical conditions, that the  
15 way you do that is you compare a specific measured  
16 value taken at a particular time and location to the  
17 modeled value for that time and location? Is that  
18 your testimony?

19 MR. WILL: Object to form. Asked and  
20 answered.

21 THE WITNESS: As I stated in my  
22 expert report, if you go to paragraph 19 if --

23 QUESTIONS BY MS. WILKINS:

24 Q. I'm not asking about what you stated in  
25 your expert report. I'm asking you about your

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1 testimony right now.

2           Is it your testimony right now that when  
3 you are evaluating performance of an air model that  
4 is used to look at historical conditions, that the  
5 EPA is telling you to do that by evaluating the  
6 measured data taken at a specific time and location  
7 to what the model predicts for that time and  
8 location?

9           MR. WILL: Objection. Asked and  
10 answered. Also, mischaracterizes prior  
11 testimony.

12           THE WITNESS: As I mentioned, my  
13 testimony today is consistent with as what I  
14 said in my supplemental report. If you go to  
15 paragraph 19, for the very same reason that  
16 this document says that -- USEPA 2017 says  
17 that such uncertainties do not indicate that  
18 an estimated concentration does not occur,  
19 only the precise time and location are in  
20 doubt, because of this, in fact, that I  
21 conducted nonconcurrent comparison as a  
22 preface, as an introductory part of my study.

23           So, far from what you mentioned, I,  
24 in fact, said that let's assume that only the  
25 highest measured values are of concern, and



1           then I compared it to those predicted by  
2           Mr. Sullivan's models.

3                       MS. WILKINS: Move to strike as  
4           entirely non-responsive.

5 QUESTIONS BY MS. WILKINS:

6           Q.       My question is, is it your testimony that  
7 the EPA advises to evaluate model performance of an  
8 air model that is used to simulate historic  
9 conditions by comparing measured values taken at a  
10 particular time and location to the modeled values  
11 for that time and location. Yes or no? Is that  
12 what you understand this EPA guidance to mean?

13                   MR. WILL: Object to form. Asked and  
14 answered. And mischaracterizes the document,  
15 again.

16                   MS. WILKINS: I'm not characterizing  
17 the document. I'm asking him his  
18 understanding of it.

19                   MR. WILL: He's already answered the  
20 question several times.

21 QUESTIONS BY MS. WILKINS:

22           Q.       Do you understand the question,  
23 Dr. Rouhani?

24           A.       I repeat my answer. My understanding is  
25 if the model is intended for regulatory application

1 under hypothetical extreme future conditions,  
2 calibration of the model, EPA says, is of  
3 questionable benefit. But it does not say anything  
4 about not doing any form of comparison, especially  
5 when you are dealing with historical data and where  
6 ample measurements are available.

7 Q. So you would agree with me that this  
8 section we are referring to does not advise to  
9 compare measured data to modeled data to evaluate  
10 model performance of a model that's used to evaluate  
11 or simulate historic conditions. Do you agree with  
12 that?

13 A. No, I disagree.

14 Q. Okay. If you disagree, then tell me  
15 where in this section does it advise that you should  
16 evaluate model performance of a model that's used to  
17 evaluate historic conditions by comparing measured  
18 data to modeled data?

19 A. This paragraph is about regulatory  
20 applications where models are used to simulate  
21 future hypothetical extreme conditions. It has  
22 nothing to do with what Mr. Sullivan is doing in  
23 this case.

24 Q. Okay. So this paragraph, then, has  
25 nothing to do with what you're doing in this case;

1 correct?

2 MR. WILL: Object to form.

3 Mischaracterizes prior testimony.

4 QUESTIONS BY MS. WILKINS:

5 Q. Is that correct?

6 A. I'm not aware that Mr. Sullivan is doing  
7 any regulatory applications of future hypothetical  
8 conditions. I assume, and I believe, that  
9 Mr. Sullivan has made it very clear that his goal is  
10 to simulate past historical conditions.

11 Q. Okay. So it's your opinion that  
12 Section 4.1 of the EPA 2017 guidance does not apply  
13 to Mr. Sullivan's model; is that correct?

14 A. In my opinion, this -- let me go back to  
15 that document.

16 In my opinion, the statements in  
17 Section 4.1.f do not apply to Mr. Sullivan's  
18 simulations of historical data conditions.

19 Q. Well, let's talk about all of  
20 Section 4.1, not just Subsection f. The whole  
21 Section 4.1, in your opinion, addresses only models  
22 that are used for future regulatory purposes and not  
23 models that are used to simulate past historical  
24 conditions. Is that -- do I understand your  
25 testimony accurately there?

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1 A. 4.1.f talks about --

2 Q. I'm not asking about 4.1.f. I'm asking  
3 about all of Section 4.1.

4 A. 4.1, if you read the first paragraph of  
5 it, it's very clear. This section identifies  
6 modeling approaches generally used in the air  
7 quality impact assessment of sources that emit the  
8 criteria pollutants carbon monoxide, lead, sulfur  
9 dioxide, nitrogen dioxide, and primary particulates,  
10 PM2.5 and PM10. So this section clearly covers a  
11 range of modeling.

12 The paragraph that you're citing 4.1.f,  
13 however, is specifically for regulatory  
14 applications.

15 MR. WILL: You -- when you feel  
16 there's a good time to take a break, Beth, let  
17 me know. I could use a short break.

18 THE WITNESS: Me, too.

19 MS. WILKINS: Okay. We can take a  
20 break.

21 THE WITNESS: Those bloody coffees.

22 MR. WILL: Thank you.

23 THE VIDEOGRAPHER: Off the record --  
24 off the record at 10:12.

25 (Short recess taken.)

1 THE VIDEOGRAPHER: Back on the record  
2 at 10:25.

3 QUESTIONS BY MS. WILKINS:

4 Q. Dr. Rouhani, aside from your litigation  
5 work, do you have any experience in your career in  
6 applying or interpreting these EPA guidance  
7 documents that we've been talking about from 2017  
8 and 1978?

9 A. I -- for this particular case, I've read  
10 these guidance documents, learned about them.

11 Q. Aside from this case, have you ever used  
12 either of these two guidance documents in your  
13 career?

14 A. I don't recall any.

15 Q. Now, we were talking about a section of  
16 the 1978 document that you quoted in paragraph 18 of  
17 your supplemental report.

18 A. Yes.

19 Q. Is that statement included anywhere in  
20 the 2017 guidance?

21 A. I don't recall.

22 Q. Are you able to search Exhibit 2 for that  
23 statement?

24 A. If you want, I can do that, but -- so you  
25 want the exact statement?

1 Q. Would you agree that that statement is  
2 not included in the 2017 guidance?

3 A. I agree, yes.

4 Q. And it's your opinion, then, that even  
5 though it's not included in the 2017 document, the  
6 EPA still intended that statement to be effective  
7 that was in the 1978 document; is that accurate?

8 A. I have not seen any document in EPA that  
9 negates this statement.

10 Q. So it's your opinion that the EPA did not  
11 intend to remove the statement about calibration  
12 that's in the 1978 document from the 2017 document;  
13 is that accurate?

14 A. Frankly, I don't understand the context  
15 of your question, but if you're referring to  
16 paragraph 18 of my supplemental report, it says --  
17 it quotes USEPA, page 39, this is a 1978 document,  
18 that, Any application of an air quality model may  
19 have deficiencies which come -- which cause  
20 estimated concentrations to be in error. Is.

21 That the statement that you're referring  
22 to?

23 Q. Yes. And my question is, is it your  
24 interpretation that the EPA did not intend to revoke  
25 that guidance when it didn't include it in the 2017

1 guidance?

2 MR. WILL: Object to form.

3 THE WITNESS: My understanding is  
4 that this statement is a general statement and  
5 it has not been negated by any subsequent one.

6 QUESTIONS BY MS. WILKINS:

7 Q. And it's your understanding that it's not  
8 negated by the EPA not including it in the 2017  
9 guidance; is that correct?

10 A. This is my understanding; correct.

11 Q. During your prior deposition you  
12 testified that your hourly rate in this case was  
13 \$395 an hour. Is that still your rate?

14 A. Yes.

15 Q. And since the time of your last  
16 deposition, how many hours have you spent working on  
17 this case?

18 A. I would say that, you know, about  
19 100 hours.

20 Q. And does that include both preparing your  
21 supplemental report and preparing for this  
22 deposition?

23 A. I need to verify that but I'm counting --  
24 this is my rough estimate of both.

25 Q. Okay. How many hours, approximately, did

1 you spend preparing for this deposition?

2 A. I re-read and -- re-read my documents, I  
3 re-read some of the key documents, and I would say  
4 that about 20 hours.

5 Q. Did you meet with any of the attorneys in  
6 this case in order to prepare for your deposition  
7 today?

8 A. We had a Zoom meeting yesterday.

9 Q. Just -- just one Zoom meeting to prepare  
10 for the deposition?

11 A. Yes, because this is the first time I'm  
12 using Zoom and our system locked Zoom, so we made  
13 sure that it would work on my end.

14 Q. Okay. So between the time that your  
15 supplemental report was submitted and today, did you  
16 only have one conversation with the attorneys?

17 A. There could be -- I would say that I  
18 recall another web meeting last week.

19 Q. How long did that meeting last?

20 A. I think it was -- it lasted about an  
21 hour.

22 Q. And your meeting yesterday, how long did  
23 that last?

24 A. I would say -- oh, that one I remember  
25 because I had to go to another meeting. Two hours.



1 Q. So in your meeting yesterday, you weren't  
2 just talking about how to use Zoom; correct?

3 A. It took a long time because my system --  
4 the system in my company was blocking it, so I had  
5 to do a lot of back and forth with my IT guys until  
6 I got the permission.

7 Q. But in those two meetings that you had  
8 with counsel, you were discussing the substance of  
9 your report and testimony; is that accurate?

10 A. Yes.

11 Q. Okay. So since the time of your last  
12 deposition you have billed approximately \$40,000 in  
13 this case?

14 A. Probably, yes.

15 Q. Do you have records of your -- your time  
16 and billing?

17 A. Yes.

18 Q. Let's switch gears a little bit.

19 Well, before we do, you'll see in the  
20 Chat box that Gretta was able to mark our 2017 EPA  
21 guidance with an Exhibit 2 sticker. Do you see  
22 that?

23 A. Yes.

24 Q. And can you just confirm for the record  
25 that that's the same EPA guidance that we have been

1 talking about today and that's referenced in your  
2 report?

3 A. Sure. And I need to now look at my other  
4 screen, I apologize.

5 Yes, it seems to be the same document.

6 Q. Okay. So would you agree that when a  
7 model is considering -- when an air model is  
8 considering the impact of environmental exposure to  
9 human health, the long-term exposure is more  
10 important than what is happening day by day?

11 MR. WILL: Object to form.

12 THE WITNESS: Can you repeat your  
13 question?

14 QUESTIONS BY MS. WILKINS:

15 Q. Sure. Would you agree that when a  
16 model -- an air model is being created to consider  
17 the impact of environmental exposures to human  
18 health, what is important to consider is not the day  
19 by day exposure but the long-term exposure?

20 MR. WILL: Object to form.

21 THE WITNESS: In this case, I did not  
22 consider this question, and I was not asked to  
23 consider this question.

24 QUESTIONS BY MS. WILKINS:

25 Q. Okay. Well, I'm asking you to consider

1 it now, if you can. Do you have an opinion on  
2 whether a model that is created in order to consider  
3 the impact of environmental exposures on human  
4 health, that it's more important to consider the  
5 long-term exposure or day by day exposures?

6 A. I need to think about it. At this -- at  
7 this moment, I don't have any specific, you know,  
8 answer for you.

9 Q. Do you agree that when the EPA sets  
10 regulatory standards in order to protect public  
11 health, they're not considering day by day exposure  
12 rates, they're considering either quarterly or  
13 annual rates?

14 MR. WILL: Object to form. Lack of  
15 foundation.

16 THE WITNESS: Again, it varies from  
17 chemical to chemical. And frankly, at this  
18 stage, I don't have an answer for you. I need  
19 to study this in detail before I can express  
20 an opinion.

21 QUESTIONS BY MS. WILKINS:

22 Q. Okay. Would you agree that -- well,  
23 let's put it in context of the smelter in La Oroya.  
24 Would you agree that daily exposure to air lead from  
25 smelter sources can vary greatly based on a number

1 of factors?

2 MR. WILL: Object to form. Beyond  
3 the scope of his testimony and the report.

4 THE WITNESS: I have not been asked  
5 to look at -- look into this question. At  
6 this stage, I don't have an answer for you.

7 QUESTIONS BY MS. WILKINS:

8 Q. Okay. Well, would you agree that daily  
9 exposure can vary based on the weather? So the  
10 weather today might cause my exposure to be  
11 different than the weather tomorrow?

12 MR. WILL: Same objection.

13 THE WITNESS: I mean, I don't  
14 disagree with your statement but, as an  
15 opinion, I don't have an answer for you today.

16 QUESTIONS BY MS. WILKINS:

17 Q. Do you intend to testify about that topic  
18 at trial?

19 A. I have not been asked.

20 Q. To what extent do you understand, if at  
21 all, variation in wind direction to affect the  
22 evaluation of air modeling performance?

23 A. I believe --

24 MR. WILL: Object to form.

25 THE WITNESS: I believe that these

1 are the elements that the modelers are taking  
2 into account.

3 QUESTIONS BY MS. WILKINS:

4 Q. Is it your opinion that you don't need to  
5 take those factors into account when you're  
6 evaluating the performance of an air model?

7 A. I'm assuming that the modelers have done  
8 their best to generate a reliable, or as reliable a  
9 model, as possible, and for that purpose, they've  
10 taken those adequately into account.

11 Q. And it's outside of your area of  
12 expertise to consider factors such as weather, or  
13 wind direction, or wind speed when you are  
14 statistically evaluating the performance of an air  
15 quality model.

16 Do you agree with that?

17 MR. WILL: Object to form. Assumes  
18 facts not established.

19 THE WITNESS: The focus of my review  
20 in this case was to look at the performance of  
21 Mr. Sullivan's models based on the results  
22 that he provided and based on measured values  
23 that he also provided.

24 QUESTIONS BY MS. WILKINS:

25 Q. Okay. Would you agree that weather, wind

1 direction, and wind speed are factors that an air  
2 modeler considers when creating an air model?

3 A. I believe that this is -- I don't  
4 disagree with your statement. I think that this is  
5 something that modelers do consider.

6 Q. And do you have the expertise to consider  
7 the effect of weather, or wind direction, or wind  
8 speed when you are statistically evaluating the  
9 performance of an air quality model?

10 MR. WILL: Objection. Assumes facts  
11 not established.

12 THE WITNESS: In this case, as you  
13 mention, I'm comparing predicted values, which  
14 are provided by Mr. Sullivan, and measured  
15 factors, which are also provided by  
16 Mr. Sullivan.

17 QUESTIONS BY MS. WILKINS:

18 Q. Okay. But I'm asking you, is it within  
19 your area of expertise to evaluate the variability  
20 of weather, wind direction, or wind speed when you  
21 are evaluating an air quality model?

22 MR. WILL: Object to scope. Beyond  
23 the opinions established in the report.

24 THE WITNESS: I did not consider  
25 those variations in my assessment of

1 Mr. Sullivan's models.

2 QUESTIONS BY MS. WILKINS:

3 Q. And those consideration are -- are not  
4 within your area of expertise; correct?

5 A. I -- I'm not a meteorologist, you're  
6 correct.

7 Q. Well, and you're not an air modeler  
8 either; right?

9 A. I'm not.

10 Q. Do you agree that it's normal for wind  
11 direction to vary both from hour-to-hour and even  
12 within an hour at a given location?

13 A. Again, I don't disagree with your  
14 statement but, at this moment, I'm not prepared to  
15 opine on -- on that statement.

16 Q. Well, do you agree generally that wind  
17 direction at 11 o'clock today is likely to be  
18 different from wind direction at 11 o'clock tomorrow  
19 and wind direction at 11 o'clock yesterday in the  
20 same location?

21 A. I don't disagree with your statement.

22 Q. And would you agree the same for wind  
23 speed, that the wind speed at 11 o'clock today in my  
24 yard is likely to be different from the wind speed  
25 at 11 o'clock yesterday and 11 o'clock tomorrow?

1           A.       I don't disagree with your statement.  
2 These were not the focus -- or these were not  
3 included in my assessments.

4           Q.       Is it your understanding that even though  
5 wind pattern and wind speed, can be very --  
6 extremely variable from hour-to-hour or day-to-day,  
7 that when you look at them on a more long-term  
8 basis, like, monthly or annually, you tend to see an  
9 averaging?

10                       MR. WILL: Object to form.

11                       THE WITNESS: I have not looked into  
12 that specific question but I don't disagree  
13 with your statement.

14 QUESTIONS BY MS. WILKINS:

15           Q.       And so specific to La Oroya, would you  
16 agree that wind flow at, for example, the Sindicato  
17 station, can be very different than the wind -- wind  
18 flow at the Marcavalle station at the exact same  
19 time?

20           A.       I have not looked into that question so,  
21 at this stage, I'm not -- I cannot answer your  
22 questions.

23           Q.       Well, have you ever sat outside and  
24 noticed to your right, the leaves might be blowing  
25 to the south, and to your left, they might be



1 blowing to the east? Have you ever experienced  
2 something like that?

3 MR. WILL: Object to relevance.

4 THE WITNESS: I don't disagree with  
5 your statement but -- but I'm trying to keep  
6 remembering a situation when I saw two  
7 different directions on two sides of my house  
8 and I don't remember any, but you may be  
9 right, I don't know.

10 QUESTIONS BY MS. WILKINS:

11 Q. So would you agree that if we're talking  
12 about two different monitoring stations in La Oroya,  
13 it's highly likely that at the same time the wind  
14 speed and direction there at those two different  
15 stations is likely to be different?

16 MR. WILL: Object to form. Lack of  
17 foundation. Relevance.

18 THE WITNESS: They could be  
19 different. I don't know how likely that  
20 situation is. I've not -- I was not asked to  
21 investigate variations of air current and air  
22 flow and speed at different stations.

23 QUESTIONS BY MS. WILKINS:

24 Q. Let me ask you it a different way. If  
25 you were to look at the wind speed direction for the

Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021  
A.O.A., et al. vs DOE RUN RESOURCES CORPORATION, et al.,

1 same point in time at the Marcavalle --

2 A. Excuse me, just a second, please. Okay.  
3 Continue, sorry.

4 Q. If you were to look at the wind speed and  
5 direction for the same point of time for the  
6 Sindicato station, the Marcavalle station, would you  
7 expect them to be the same?

8 MR. WILL: Objection. Relevance.  
9 Lack of foundation.

10 THE WITNESS: I have not looked into  
11 this question and, until I look at the data, I  
12 cannot answer your question.

13 QUESTIONS BY MS. WILKINS:

14 Q. But it's not part of the evaluation that  
15 you have done in this case, to look at that data;  
16 correct?

17 A. I did not look into the wind variations  
18 during my assessment of Mr. Sullivan's models.

19 Q. And in your opinion, it's not important  
20 for you to do that; correct?

21 A. My opinion is based on whether  
22 Mr. Sullivan's statements are reliable or not.

23 Q. Would you agree that you wouldn't expect  
24 emissions from the La Oroya complex to be the same  
25 at every hour of the day, every day of the year?

1           A.       I don't expect that, no. But again, I've  
2 not looked at the data, so I'm just guessing, just  
3 like you.

4           Q.       So would you agree that since we don't  
5 expect emissions rates to be the same hour-by-hour,  
6 day-by-day, you can't expect an air quality model to  
7 match hour-by-hour to the measured rates; is that  
8 fair?

9           A.       Again, I am -- when a model is presented  
10 as a reliable model, it should. If you don't model  
11 it on the basis of hour-by-hour is a different  
12 story.

13          Q.       So even though the emissions rates might  
14 be very different hour-by-hour, it's your opinion  
15 that the model should be able to accurately predict,  
16 hour-by-hour air conditions?

17          A.       When you present your model results on an  
18 hour-by-hour basis, and present it as being  
19 depicting real conditions, then they should match,  
20 to the extent possible, observed values.

21          Q.       Okay. Is it your opinion that  
22 Mr. Sullivan has presented his model on an  
23 hour-by-hour basis?

24          A.       This is what I got from him for some of  
25 the parameters.

1 Q. I'm sorry, could you repeat that?

2 A. This is what he provided as part of his  
3 reliance material for certain conditions.

4 Q. But is Mr. Sullivan, in his expert  
5 report, presenting his model on an hour-by-hour  
6 basis?

7 A. He provided reliance files, Excel  
8 files --

9 Q. I'm not talking about his reliance files.  
10 I'm asking about the model that he is presenting in  
11 his expert report. Is he presenting a model to  
12 predict air quality on an hour-by-hour basis?

13 A. That is the basis that -- how he  
14 calculates his SO<sub>2</sub>, sulfur dioxide.

15 Q. Well, what is the model that he's  
16 presenting for sulfur dioxide?

17 A. These are hourly models for 2007.

18 Q. Now, how about for lead? Is he  
19 presenting that on an hour-by-hour basis?

20 A. I believe that those are daily.

21 Q. And what about arsenic? Is that  
22 presented on an hour-by-hour basis?

23 A. I believe that those are also daily.

24 Q. Are you aware that Mr. Sullivan actually  
25 used emissions rates that were averaged over one

1 month intervals for his modeling purposes, not daily  
2 or hourly?

3 A. I did not look at his emission rates.

4 Q. Are you familiar with the EPA National  
5 Ambient Air Quality Standards for --

6 A. Yes.

7 Q. -- lead and sulfur dioxide?

8 A. I believe so, yes.

9 Q. And particulate matter?

10 A. Yes.

11 Q. Would you agree that those air quality  
12 standards are created with the intention to protect  
13 public health?

14 A. I believe so, yes.

15 Q. And do you agree that those air quality  
16 standards are created looking at monthly, quarterly,  
17 or yearly -- yearly, monthly, or quarterly  
18 measurements, not daily or hourly?

19 A. I -- I have not studied them to that  
20 extent so I don't -- and I was not asked to do so.

21 Q. Do you know what the National Air --  
22 Ambient Air Quality Standard is for lead in the  
23 U.S.?

24 A. No, not -- I need to go and look up.

25 Q. Can you name one National Ambient Air

1 Quality Standard in the U.S. that uses pairing in  
2 space and time?

3 A. I don't understand your question.

4 Q. All right. Do you know what I mean by  
5 pairing in space and time?

6 A. No.

7 Q. Okay. That's not a term that you're  
8 familiar with?

9 A. I mean, you're a lawyer. I don't know  
10 what you mean by pairing space and time.

11 Q. So that's not a term that you're familiar  
12 with at all from air quality monitoring?

13 A. If you show me the reference, then I can  
14 tell you what does it mean.

15 Q. I'm not asking you about any particular  
16 reference. I'm asking you if you are familiar, in  
17 relation to air quality monitoring, with the term  
18 "pairing in space and time?"

19 A. I'm not familiar. If you give me the  
20 reference, I'll be more than happy to review it and  
21 give you my answer.

22 Q. Okay. So you don't understand pairing in  
23 time and space as it refers to air modeling to mean  
24 analyzing how well a model estimates air  
25 concentrations at a -- of a given substance at a

1 specific time and location?

2 A. In some context, it may mean that, yes.

3 Q. And in your career, have you encountered  
4 a context where pairing in time and space means  
5 analyzing how well an air model estimates air  
6 concentrations of a given substance at a particular  
7 time and location?

8 A. In fact, this is what I did to assess the  
9 reliability of Mr. Sullivan's models.

10 Q. But you're just not familiar with that  
11 term being used for it; is that fair?

12 A. Not in a -- in a general context that you  
13 are defining about a regulatory level based on  
14 pairing of space and time. I have not -- I'm not  
15 familiar with that application of that phrase to a  
16 regulatory level.

17 Q. Okay. Well, then, would you agree that  
18 the EPA National Ambient Air Quality Standards don't  
19 look to a specific location or time to determine  
20 compliance?

21 MR. WILL: Object to form. Lack of  
22 foundation.

23 THE WITNESS: In fact, for the  
24 ambient condition, it's very -- it says in the  
25 title, it is for ambient conditions. So it's

1 not for a specific location.

2 QUESTIONS BY MS. WILKINS:

3 Q. So you would agree, then, that when the  
4 EPA sets standards to protect public health, they  
5 are not looking to regulate air concentrations of a  
6 given substance at a particular time and location?

7 A. When it's -- when we're talking about  
8 ambient conditions, unless it is for a specific  
9 period of time, then it is a general number for all  
10 locations.

11 Q. Do you agree, then, that daily or hourly  
12 averages are not what the EPA considers when setting  
13 standards to protect public health?

14 MR. WILL: Object to form.

15 Overbroad. Vague.

16 THE WITNESS: It's really vague and  
17 it's very hard to answer your question in an  
18 affirmative manner because, depending on the  
19 chemical, and what criteria are being used,  
20 you may use average daily values, you may use  
21 averages over other time periods, depending on  
22 the chemical and chemical characteristics, or  
23 I should say toxicological characteristics of  
24 those chemicals.

25 / / /



1 QUESTIONS BY MS. WILKINS:

2 Q. Okay. Well, let's talk about the  
3 chemicals that are at issue in this case.

4 A. Yes.

5 Q. Would you agree that when the EPA  
6 considers setting standards to protect public health  
7 relevant to lead air concentrations, it's not  
8 considering daily or hourly averages?

9 A. I believe they do because they -- they  
10 have to simulate a condition for a sensitive  
11 receptor in order to define what should be the daily  
12 value, monthly value, so on and so forth. So I  
13 believe that they look at those. So I'm a bit  
14 puzzled by your question.

15 Q. So is it your opinion that the EPA sets  
16 daily allowable -- allowable standards for lead in  
17 the U.S.?

18 A. I don't know because I have to go and  
19 look up.

20 Q. Now, for sulfur dioxide, do you  
21 understand the USEPA to set daily or hourly  
22 standards?

23 A. I don't know.

24 Q. And for particulate matter, do you have  
25 an understanding of whether the EPA sets daily or

1 hourly standards?

2 A. I don't know. I need to go and look up.

3 (Deposition Exhibit 3 marked

4 for identification.)

5 QUESTIONS BY MS. WILKINS:

6 Q. I am marking Exhibit 3 and I will put it  
7 in the Chat panel. It should be there now.

8 A. Sorry, I need to look at my other screen.  
9 Okay.

10 Q. Do you recognize this document?

11 A. It is the national ambient tables.

12 Q. Okay. So you agree that this is a table  
13 of certain ambient air quality standards set by the  
14 EPA in order to provide public health protection?

15 A. I don't know the exact text of that  
16 document but this is what it looks like.

17 Q. Okay. So I'll ask more specifically, do  
18 you see an entry on the table for lead?

19 A. Yes.

20 Q. And do you understand that to be the air  
21 quality standard that the EPA has determined not to  
22 be exceeded for lead in order to provide public  
23 health protection?

24 A. It says -- the document says so, yes.

25 Q. So when the EPA sets standards for air

1 concentrations of lead, is it using a daily or  
2 hourly average?

3 A. It's using a rolling three-month average.

4 Q. So would you agree that's a quarterly  
5 average?

6 A. A rolling quarterly average. It's not  
7 exactly quarterly, the way you lawyers view  
8 quarterly.

9 Q. Okay. But it's not daily or hourly;  
10 correct?

11 A. No.

12 Q. And if you scroll down to particulate  
13 matter, do you see the entries for particulate  
14 matter?

15 A. Yes.

16 Q. And for PM2.5, the EPA is not considering  
17 an hourly or daily standard; correct?

18 A. In fact, they have one for 24 hours,  
19 according to this table. It's daily.

20 Q. Correct, but how is that determined?  
21 It's determined by an average over a 3-year time;  
22 correct?

23 A. The 98th percentile average over a 3-year  
24 period.

25 Q. What do you understand that to mean?

1           A.       This means that you get all your hourly  
2 values, then, over a 3-year period you will pick the  
3 98th percentile of -- of the measurements that you  
4 have, hourly measurements that you have.

5           Q.       So you agree, then, what the EPA is doing  
6 here for Particulate Matter 2.5 with regard to  
7 setting a standard not to be exceeded in a 24-hour  
8 time period is that the EPA is looking at 3 years of  
9 data and saying what cannot be exceeded is the  
10 fourth or fifth highest measurement that occurred  
11 within those 3 years; right?

12                   MR. WILL: Object to form. The  
13 document speaks for itself.

14                   THE WITNESS: These are health-based  
15 criteria and not only they look at the data  
16 but they also look at what is a -- a safe  
17 level that can be used as a regulatory basis.  
18 So it may have nothing to do with actual  
19 measurements but what a human being or a  
20 sensitive receptor should not be exposed to  
21 more than 2 percent of times over a period of  
22 24 hours.

23 QUESTIONS BY MS. WILKINS:

24           Q.       Now, my question is when the EPA is  
25 developing these standards, the information that

1 they're looking at is annual averages over 3 years  
2 when we're talking about PM2.5; right?

3 A. These are exposure concentrations. So  
4 over a given period, let's look at PM2.5, the third  
5 line item for it, for 24 hours, they would like to  
6 make sure that a sensitive receptor should not be  
7 exposed no more than 2 percent of times over a  
8 3-year period to 35 micrograms per cubic meter.  
9 So --

10 Q. Would you --

11 A. -- they may have used actual data or they  
12 may have used health -- health-based data that, what  
13 is a safe level, and these criteria are  
14 representative of those.

15 Q. So you don't know what data the EPA used  
16 to create these standards?

17 A. Correct.

18 It's noon Atlanta time. Are we going to  
19 have a lunch break or do you want to go to St. Louis  
20 time?

21 Q. What is your preference? I don't have  
22 one.

23 A. I mean, it's your call.

24 MS. WILKINS: Bob?

25 MR. WILL: As long as the witness is

1           okay to continue, I -- I'll leave it up to  
2           you, Beth.

3                       MS. WILKINS:   Okay.   Let's -- let's  
4           go maybe another hour or so, since we just  
5           took a break --

6                       THE WITNESS:   Sure.

7                       MS. WILKINS:   -- but if anyone needs  
8           a break before then, just speak up.

9                       THE WITNESS:   Okay.

10       QUESTIONS BY MS. WILKINS:

11           Q.       Okay.   Would you agree that when  
12       performing air modeling to determine potential human  
13       health risks, what matters from a health perspective  
14       is the long-term average exposure over months or  
15       years and not the short-term exposure over days or  
16       hours?

17                       MR. WILL:   Object to form.   Lack of  
18       foundation.   Beyond the scope of his opinions.

19                       THE WITNESS:   If you're using the  
20       criteria such as -- such as this, then yes,  
21       you will -- for example, you want to know that  
22       what is the PM2.5's primary and secondary  
23       criteria over a 24-hour period, you will --  
24       you are looking at the 98th percentile of  
25       average value over 3 years to conclude that

1 the simulated results indicate an exceedance  
2 or not.

3 QUESTIONS BY MS. WILKINS:

4 Q. And would you agree that, in regulatory  
5 settings, air models are not evaluated in space and  
6 time, meaning they're not evaluated by pairing up an  
7 hourly measurement at a specific location with the  
8 modeled measurement at that time and location?

9 A. Regulatory applications are generally  
10 intended for the future extreme hypothetical  
11 conditions. And -- and for those, you know, then  
12 using these specific time periods, and averaging  
13 time periods, is appropriate, yes.

14 Q. And so my question is that this pairing  
15 in space and time, comparing a measured data point  
16 at a particular time and location to the modeled  
17 number for that time and location, that's not done  
18 in a regulatory setting. Agree?

19 A. As I mentioned it before, many, many,  
20 times, in a regulatory application we're concerned  
21 about hypothetical extreme future conditions. In  
22 those conditions, unless you have data which are  
23 representative of those hypothetical extreme  
24 conditions in the future, comparisons are not  
25 common.

1 Q. Other than in this case, have you ever  
2 evaluated an air model by comparing measured data at  
3 a specific time and location to the model for that  
4 time and location?

5 A. I believe that there were a number of  
6 confidential studies that I did, modeling was done  
7 by somebody else, but I compared it to the actual  
8 measured values to assess the reliability of those  
9 model results.

10 Q. About how many occasions have you done  
11 that?

12 A. Right now, 2, 3, you know, half a dozen  
13 comes to my mind.

14 Q. Were those all in the context of  
15 litigation?

16 A. They were -- many of them were within the  
17 context of permitting.

18 Q. And in those occasions, do I understand  
19 correctly that what you were doing was what I'm  
20 calling pairing in space and time, which, I mean,  
21 taking a measured air quality data point and  
22 comparing it to the same modeled point for that time  
23 and location?

24 A. It included that, too, yes.

25 Q. Okay. So in those 2 or 3 or half dozen



1 occasions where you have evaluated an air quality  
2 model by comparing a measured data point to a  
3 modeled data point at a particular time and  
4 location, have you ever found good correspondence  
5 between modeled measured data?

6 A. In -- in those locations, the situation  
7 that I was looking at, there were a few of them that  
8 agreements were within acceptable ranges, and in  
9 some cases they were not.

10 Q. What do you determine to be an acceptable  
11 range?

12 A. For example, if the objective was to have  
13 an estimate of a particular statistic such as annual  
14 mean average, something like that, then compared to  
15 the observed values, if it was within 10 percent,  
16 20 percent, I would have considered that as being  
17 reasonable; reasonably reliable.

18 Q. And you're talking about an annual mean  
19 average but what I'm asking you about is what you  
20 did here when you compared a measured data at a  
21 particular time and location to the modeled value  
22 for that time and location, not an annual average,  
23 not a monthly average, but the specific data point.  
24 In these prior instances, have you done that?

25 A. In one of the cases I recall that the

1 confidential case was about a potential release and  
2 the -- the resolution was quite finite both in space  
3 and time. And therefore, the model evaluation was  
4 also -- was done in accordance to that resolution.

5 Q. So am I understanding you correctly that,  
6 aside from this case, you have only one other time  
7 evaluated an air quality model by comparing a  
8 specific measured value at a discreet time and  
9 location to the modeled value at that time and  
10 location? Is that correct?

11 A. Because that was the objective of the  
12 study and, therefore, evaluation was done  
13 accordingly.

14 Q. Okay. So my question is, aside from this  
15 case, you've only done that one time; isn't that  
16 true?

17 A. This is what comes to my mind. There  
18 could be more but --

19 Q. Okay.

20 A. -- as of now, that's the only one I  
21 remember.

22 Q. Okay. In that case, did you find good  
23 correspondence between the model and the measured  
24 data?

25 A. I don't recall that. I don't recall the

1 exact conclusions.

2 Q. Do you recall whether you concluded that  
3 the model could accurately or reliably model air  
4 concentrations or air quality on an hourly or daily  
5 basis?

6 A. I believe that, in that study, it was a  
7 weight of -- the weight of evidence approach which  
8 was being used and the model was used as one of the  
9 lines of evidence. It was not the sole evidence but  
10 one of the lines of evidence.

11 Q. Okay. That doesn't answer my question.  
12 My question was, do you recall whether,  
13 in that occasion, you concluded that the air model  
14 used could accurately or reliably model air quality  
15 on an hourly or daily basis?

16 A. I don't recall the exact conclusion.

17 Q. Do you recall anytime in your career ever  
18 concluding that an air quality model could  
19 accurately or reliably predict hourly or daily air  
20 quality at a particular location?

21 A. I -- I don't recall any case that -- as I  
22 told you this day, I have reviewed only a handful of  
23 models.

24 Q. Do you recall ever, in any literature  
25 you've reviewed, any instance where an air quality

1 model was able to reliably predict air quality at a  
2 given location at a specific time?

3 A. The ones that I remember published in  
4 reviewed journals, they never presented their  
5 results as being reliable on an hourly value. They  
6 were, instead, showing the reliability of their  
7 model on the basis of some long-term averages.

8 Q. So you agree, then, that you are not  
9 aware of any literature that has found an air  
10 quality model to be reliable when it is examined in  
11 the way that you're examining it in your report by  
12 matching specific hourly or daily measurements to  
13 the modeled results for that same time and location.

14 A. As I recall that in those published  
15 results, they show the results of concurrent, you  
16 know, comparisons, but almost -- most -- now, I'm  
17 just sitting here, I'm just relying on my memory, of  
18 the ones that I reviewed, the final conclusions were  
19 always driven by some sort of a long-term average.  
20 But they always showed the results of concurrent  
21 comparison just to show people that what is the  
22 reliability of their model.

23 Q. Did you cite any of those articles in  
24 your report?

25 A. I need to go and look. I don't -- if you

1 want, I can go over the reference list to see that.  
2 I recall that -- I need to look at my reference  
3 lists but I don't believe that in this case -- for  
4 example, McVehil, is a great example, that  
5 Mr. Sullivan, in fact, has cited. And McVehil, in  
6 fact, shows a variety of statistics based on his  
7 results to highlight the -- the reliability of his  
8 model.

9           And as I said, when I did the comparison  
10 and review of Sullivan's reports, I started with  
11 nonconcurrent, the results were awful, gross  
12 under-estimations, gross over-estimations, and of  
13 primary long-term matrix -- statistics that he is  
14 allegedly using, and those results were further  
15 highlighted when I did the concurrent measurements.

16           MS. WILKINS: Move to strike  
17 everything from "And as I said," and after.

18 QUESTIONS BY MS. WILKINS:

19       Q.     Is it your testimony that the McVehil  
20 article you just referenced involved an air quality  
21 model that was reliable when evaluated by comparing  
22 a measured result from a particular time and  
23 location to the model result for that same time and  
24 location?

25       A.     In fact, what I've cited in my -- in my

1 supplementary report, which I'm going to recite for  
2 you, if you go to paragraph -- okay, In fact, Dr. --  
3 as I said in paragraph 18 of my report, In fact,  
4 Dr. McVehil, MMA 2008a and 2008b, subjected his  
5 model to several statistical evaluations to validate  
6 and calculate his reported results and extent -- to  
7 the extent practical. These included inspections of  
8 quantile-quantile plot of predicted values versus  
9 measured data, as well as analyses of computed  
10 Fractional Bias.

11               So he also included an Absolute  
12 Fractional Bias, he included Root Mean Square  
13 Errors, and Average -- Average Bias analysis. So he  
14 performed all of these works that demonstrates the  
15 reliability of his report. Mr. Sullivan never  
16 presented any results in any quantifiable manner  
17 about the reliability of his models.

18               MS. WILKINS: Move to strike as  
19 non-responsive.

20 QUESTIONS BY MS. WILKINS:

21           Q.     The Dr. McVehil document that you're  
22 referencing is McVehil's air model that he created  
23 with regard to the La Oroya complex; correct?

24           A.     I believe so, yes.

25           Q.     Okay. And you say in your supplemental

1 report that Dr. McVehil did, for example, a Root  
2 Mean Square Error analysis; right?

3 A. He performed all these analyses and I'll  
4 be more than happy to recite them for you.

5 Q. No, I just want to know that you agree  
6 that he performed, among other things, a Root Mean  
7 Square analysis -- or Error Analysis; correct?

8 A. Yes.

9 Q. Okay. Is that also referred to as  
10 R-squared?

11 A. No, it is slightly different.

12 Q. Okay. Did Dr. McVehil evaluate his own  
13 model by comparing specific measured values to the  
14 modeled measurements at a given time and location?

15 A. He has that quantile plots of predicted  
16 versus measured results. He also compares  
17 statistics at each location of variable durations.  
18 So --

19 Q. Is his plot of predicted versus measured  
20 results, is it -- what time frame is it? Is it  
21 daily? Is it hourly? Is it yearly? Is it monthly?  
22 What time frame is it?

23 A. When he says measured, probably he refers  
24 to a specific measurements, but I need to look at  
25 his report to refresh my memory what time basis he

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1 used.

2 Q. And do you know whether his model was  
3 reliable when evaluated by comparing a specific  
4 measurement at a given time and location to the  
5 modeled value at that time and location? Do you  
6 know?

7 A. I did not do that. I was not asked to  
8 evaluate his models, so I cannot --

9 Q. Okay.

10 A. -- answer that question.

11 Q. So we'll put Dr. McVehil's model aside.

12 The question that I asked you previously,  
13 when you referred to Dr. McVehil's report, is  
14 whether you can cite to any article, any piece of  
15 literature, any reference material, where an air  
16 quality model was evaluated by comparing a measured  
17 data point at a particular time and location to the  
18 modeled value at the same time and location. Can  
19 you -- can you show me one?

20 A. I would just referring to Dr. -- I refer  
21 you to Dr. McVehil.

22 Q. But you just told me that you didn't  
23 evaluate his model to see whether it was --

24 A. He compared predicted versus measured.

25 Q. Okay. Other than Dr. McVehil's, can you



1 point me to any article, any reference material, any  
2 source that finds good model performance when you  
3 compare a measured value at a given time and  
4 location to the modeled value at that time and  
5 location?

6 A. For example, the EPA document that we  
7 were going around, under the regulatory level --  
8 excuse me, just a second.

9 Under a regulatory basis -- I'm sorry,  
10 let me start again.

11 As I mentioned, it talks about the errors  
12 that happen when you compare highest measurements,  
13 and the margins are between 10 to 40. Clearly,  
14 people have compared it. This is my understanding.  
15 And they even have numbers of 10 to 40 percent. And  
16 when I did nonconcurrent, Mr. Sullivan's results  
17 were far from those margins of error.

18 MS. WILKINS: Move to strike as  
19 non-responsive.

20 QUESTIONS BY MS. WILKINS:

21 Q. My question is, can you refer me to any  
22 article that has evaluated an air quality model by  
23 comparing a measured observation to a modeled  
24 observation at a given time and location, and found  
25 good performance? Can you cite me to an article

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1 that does that?

2 A. I have not looked into it, I was not  
3 asked to do it, but it can be done.

4 Q. And you didn't find that important to do  
5 to support the methodology that you used in your  
6 report?

7 A. I looked at the EPA, which very clearly  
8 states that, under 2017, to use nonconcurrent, and I  
9 did that. And Mr. Sullivan's model results are far  
10 from --

11 Q. Okay. As we --

12 A. -- accepted typical margins of error.

13 Q. As we sit here right now, you cannot  
14 reference a single article or a single occurrence  
15 where you are aware that a researcher evaluated an  
16 air quality model by comparing a measured  
17 observation at a particular time and location to the  
18 modeled observation at that same time and location,  
19 and found good performance.

20 MR. WILL: Object to form.

21 THE WITNESS: As I said, I -- I  
22 relied on EPA guidance which, in fact, cites  
23 references, which these 10 to 40 percent  
24 margin of error was cited.

25 / / /

1 QUESTIONS BY MS. WILKINS:

2 Q. Earlier we talked a little bit about the  
3 Huanchan site. Did you review Dr. McVehil's  
4 modeling with regard to the Huanchan site?

5 A. I used the statistics that he had  
6 provided for comparison purposes.

7 Q. Are you aware that both Dr. McVehil's  
8 modeling and Mr. Sullivan's modeling very much  
9 understate the air concentrations at Huanchan?

10 A. Yes.

11 Q. Are you aware that Dr. McVehil put an --  
12 a massive imaginary building into his model to try  
13 to make his model have better performance at  
14 Huanchan?

15 A. I learned that from Mr. Sullivan's  
16 statements.

17 Q. So in your own review of Dr. McVehil's  
18 modeling, you didn't understand that he had put in a  
19 huge imaginary building?

20 A. As I said, by the time I started  
21 reviewing Dr. McVehil, I was fully aware of that  
22 situation based on Mr. Sullivan's statements.

23 Q. Do you have any understanding of why both  
24 models underpredict the air concentrations at  
25 Huanchan?

1           A.       No. I can guess but I cannot opine on  
2 it.

3           Q.       What is your guess?

4           A.       You don't want me --

5                   MR. WILL: Object.

6                   THE WITNESS: -- to speculate.

7                   MR. WILL: Calls for speculation.

8                   THE WITNESS: I don't want to testify  
9 based on speculation.

10 QUESTIONS BY MS. WILKINS:

11          Q.       Okay. Do you have an opinion on whether,  
12 if regression analysis was performed on an annual  
13 average basis for lead, would the correlation from  
14 Mr. Sullivan's model improve if the Huanchan site  
15 were not included?

16          A.       I didn't know about this one. I compared  
17 each station separately.

18          Q.       Okay. But I'm asking you to -- to  
19 consider it now. Well, let's take a step back.

20                   In your report, your supplemental report,  
21 you actually combine all of the locations together  
22 and perform a regression analysis on the combined  
23 sites; correct?

24          A.       No.

25          Q.       All right. We'll come back to that.

1           So what I'm asking you now, and I  
2 understand you didn't address this in your report,  
3 but I'm asking you if you're able to provide an  
4 opinion on it. You understand that Mr. Sullivan's  
5 model, as well as Dr. McVehil's model, aren't able  
6 to very accurately predict what's going on at  
7 Huanchan. Do you agree with that?

8           A.     Well, for Mr. Sullivan's models, for that  
9 matter, for every station, the same is true.

10          Q.     I'm asking about Huanchan. Do you agree  
11 that Dr. McVehil's model --

12          A.     In fact, probably the best way to do it  
13 is to look at my Figure --

14          Q.     No, that's not what I'm asking.

15          A.     -- Figure 1.

16          Q.     Could you stick with my question, please?

17          A.     Okay.

18          Q.     Do you agree that Dr. McVehil's model  
19 isn't able to accurately predict air concentrations  
20 at Huanchan?

21          A.     I need to go and look at the results,  
22 frankly, to give you an answer.

23          Q.     But you agree that both models, McVehil's  
24 and Sullivan's, understate the air concentrations at  
25 Huanchan; right?

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1           A.       This was my understanding but I know that  
2 Mr. Sullivan's results were grossly underestimated.

3           Q.       And the -- both models underestimate the  
4 concentrations at Huanchan by a lot; right?

5           A.       I don't know where you're getting --

6                   MR. WILL: Object to the form.

7           Vague.

8 QUESTIONS BY MS. WILKINS:

9           Q.       Do you agree?

10                  MR. WILL: Same objection.

11                  THE WITNESS: I have the results  
12 for -- for Mr. Sullivan's models on Figure 1  
13 of my -- of my results and it very clearly --  
14 both Figure 1 as well as Table 5 of my expert  
15 report, very clearly shows that Huanchan  
16 results were underestimated.

17 QUESTIONS BY MS. WILKINS:

18           Q.       And you also understand that  
19 Dr. McVehil's modeling underestimated their air  
20 concentrations at Huanchan by a significant amount.

21           A.       I need to look at the data. I don't have  
22 it right in front of me.

23           Q.       So I'm asking you, would you expect, if  
24 the Huanchan site were not included in  
25 Mr. Sullivan's model, that the correlation found

1 when performing a regression analysis of his model  
2 would improve?

3       A.       Let me -- if you allow me, if you look at  
4 the Figure 1 of my exhibit, it very clearly shows  
5 that for those results which were provided to us,  
6 which are 2007 of the results, if -- even if we use  
7 non-concurrent, and for these ones, I used a maximum  
8 rolling average, 3-month rolling average for lead,  
9 for example, all the models, all -- I'm sorry, all  
10 the locations were either grossly underestimated or  
11 grossly overestimated. To the best of my  
12 inclination, there's only one station that even  
13 falls within that margin of error that EPA was  
14 talking about.

15               So these results -- and these are  
16 nonconcurrent. You know, I did not compare  
17 daily-to-daily, hourly-to-hourly, I did not do that,  
18 but still, it shows that. Now, if we drop Huanchan,  
19 which is really the underestimated blocks to the  
20 right of the figure, it's inconsequence -- I mean,  
21 you still have a bunch of stations that -- that are  
22 very poorly estimated. The only station, if you  
23 drop all the station and only stick with Inca, then  
24 you start falling, finally, within what EPA calls  
25 the typical margins of error.

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1 MS. WILKINS: Move to strike as  
2 non-responsive.

3 QUESTIONS BY MS. WILKINS:

4 Q. My question is if just the Huanchan site  
5 were not included, do you have an opinion on whether  
6 the correlation seen in a regression analysis would  
7 improve?

8 MR. WILL: Object to the form.

9 THE WITNESS: As I said, in this  
10 case, dropping one station -- because Figure 1  
11 is for specific stations, if you drop one  
12 station, the remaining stations are still  
13 grossly underestimated or overestimated.

14 QUESTIONS BY MS. WILKINS:

15 Q. So it's your opinion that dropping  
16 Huanchan would not improve the overall correlation  
17 in a regression analysis?

18 A. It is an inconsequential outcome.

19 Q. Let's talk about Figure 2 in your  
20 supplemental report. What are you doing in the  
21 large plot in black on the left side of that figure?

22 A. Here I'm comparing measured values of  
23 lead on a daily basis and compare them to their  
24 corresponding measured values. The -- the diagram  
25 to the -- to the right are based on combined data



1 while all the plots to the left are for station  
2 specific results.

3 Q. So I think you might have transposed what  
4 you -- what you meant there. You said the diagram  
5 to the right is combined data and the plot --

6 A. I'm sorry, the -- the diagram to the  
7 left. The diagram to the left is the combined,  
8 while the diagrams, the seven diagrams, to the right  
9 are station specific.

10 Q. Okay. So what you're doing in this  
11 figure is you are taking 365 daily measured readings  
12 from seven stations and combining them into one plot  
13 on the left; is that correct?

14 A. No.

15 Q. All right. What have I got wrong there?

16 A. The measured concentrations of lead are  
17 only available every 3 days.

18 Q. Okay. So it's not 365, it's 131 or so  
19 from each station.

20 A. Probably.

21 Q. Okay. So you're taking, from each of  
22 seven stations, approximately 131 measurements that  
23 were taken every 3 days and combining them  
24 altogether in one plot; correct?

25 A. Correct.

1 Q. Okay.

2 MR. WILL: So if you want to be  
3 mathematically correct, it's closer to 120.

4 MS. WILKINS: You're right. My math  
5 was not good there; 121 not 131. That's why  
6 I'm a lawyer and not a math professor, or an  
7 accountant, or anything else.

8 QUESTIONS BY MS. WILKINS:

9 Q. And then what you did was you ran a  
10 regression analysis to look at the correlation  
11 between the measured data from those seven stations  
12 and Mr. Sullivan's model; correct?

13 A. I -- I did not do a regression analysis,  
14 I calculated the correlation, but that is just a  
15 slight difference between regression analysis and  
16 R-squared.

17 Q. Okay. You calculated the correlation  
18 using an R-squared value; right?

19 A. Yes.

20 Q. Okay. Do you have an opinion whether, if  
21 the Huanchan data was removed from this analysis, if  
22 that R-squared value would improve?

23 A. I don't know. But if you remove all the  
24 data stations other than Inca, obviously the  
25 correlation improves, but that -- it defeats the

1 purpose of this evaluation. That's the reason that  
2 I did it per station, so we also have per station  
3 characteristics, too.

4 Q. So despite your -- your expertise in  
5 statistics, you can't look at this Figure 2 and  
6 make an -- give an opinion on whether or not the  
7 R-squared value would improve by removing Huanchan.

8 MR. WILL: Objection. Improper  
9 hypothetical.

10 THE WITNESS: I mean, it -- obviously  
11 it can be done. And until I -- I was not  
12 asked to do so, and I did not see any reason  
13 to do so, and therefore, I haven't done it.  
14 But it can easily be done. And I can give you  
15 much more reliable results when I have done  
16 that analysis.

17 QUESTIONS BY MS. WILKINS:

18 Q. Well, looking at it, you can't make a  
19 prediction of what would happen to the R-square  
20 value if you removed Huanchan?

21 MR. WILL: Objection. Calls for  
22 speculation.

23 THE WITNESS: As you can see that  
24 six -- I mean, five of the stations are  
25 clearly under -- grossly underestimated. I

1 don't know what will be the exact fix if we  
2 just remove one of them. But this is, you  
3 know, part of the systematic error of this --  
4 of this model -- of these -- of this  
5 particular model.

6 MS. WILKINS: Move to strike as  
7 non-responsive.

8 QUESTIONS BY MS. WILKINS:

9 Q. You are not able to look at your plot,  
10 knowing the work that you did to create this plot,  
11 and predict whether the R-square value would go up  
12 or down if you removed Huanchan. You can't do is  
13 that?

14 A. No, I --

15 MR. WILL: Objection. Calls for  
16 speculation. Asked and answered.

17 THE WITNESS: And I don't want to  
18 speculate, and you don't want me to speculate.

19 QUESTIONS BY MS. WILKINS:

20 Q. Okay.

21 MR. WILL: It sounded like she did.

22 QUESTIONS BY MS. WILKINS:

23 Q. Let's talk about this clustering that  
24 you're seeing in the bottom left corner of your  
25 large plot. Would you agree that the data points

1 tend to cluster down in that bottom left corner?

2 A. Yes.

3 Q. And would you agree that, because of that  
4 clustering, we can't visualize the real relationship  
5 between the measured observations and the models?

6 A. That's the reason that we rely on  
7 quantitative measures such as R-squared.

8 Q. Okay. Did you consider running this on a  
9 log scale?

10 A. I did not do that.

11 Q. Would you agree that clustering like this  
12 is a common problem in a dataset when you've got a  
13 lot of variability in the data?

14 A. This is the result of predicted model  
15 results versus measured values, and as you can see  
16 that those two red dash lines are the domains that  
17 we expect a reliable model should fall within that  
18 interval. And as you can see that, and as I stated  
19 in my report, in fact, a large number of them,  
20 75 percent of the measurements, are outside of that.  
21 So whether the clustering is there, we try to do the  
22 R-square, we calculate it, how many of them fall  
23 outside of this domain, and all of them point to a  
24 highly unreliable model.

25 MS. WILKINS: Move to strike as

1 entirely non-responsive.

2 QUESTIONS BY MS. WILKINS:

3 Q. You're an expert in statistics; right?

4 A. Yes.

5 Q. Okay. Would you agree that when you plot  
6 7- to 800 data points that have a lot of  
7 variability, a problem that you often encounter is a  
8 clustering effect that doesn't allow you to see,  
9 visually, the relationship between the factors that  
10 you're plotting?

11 A. First of all, let me correct you. We  
12 don't have 700 measured plotted dots here. We only  
13 have about 120.

14 And then number 2, I answered your  
15 question, that is the reason that we rely on  
16 quantitative measures such as R-squared.

17 Q. Okay. So your plot on the left only  
18 contains 120 data points?

19 A. Roughly, yes, because these are -- in  
20 2007, I believe that there were roughly about 120  
21 lead measurements.

22 Q. So the data points on your X axes, on  
23 your left plot in black, come from where?

24 A. Both the predicted and measured values  
25 come from Mr. Sullivan's Excel files.

1 Q. The measured data points are -- are what?  
2 They're the lead values collected at what locations  
3 at what times?

4 A. Specific locations that Mr. Sullivan has  
5 indicated and the dates that Mr. Sullivan has  
6 indicated.

7 Q. Do you know from what monitoring station?

8 A. From a given monitoring station as  
9 Mr. Sullivan has identified.

10 Q. So it's a variety of monitoring stations?

11 A. Yes. Seven monitoring stations, yes.

12 Q. Why didn't you run R-squared values for  
13 the plots on the right?

14 A. Oh, we could also do that, and we have  
15 it, too. I mean, it's very easy.

16 Q. Why didn't you -- why didn't you include  
17 those in your report?

18 A. I -- I think what I wanted to show, that  
19 the results are so biased. Like, you look at the  
20 stations, other than Inca, every single station is  
21 highly biased. In those situations, R-square is  
22 really an inconsequential measure.

23 Q. Well, I agree that you wanted to show  
24 bias but let's make sure we understand that.

25 Why didn't you include the R-squared

1 value for the plot on the Inca station?

2 A. I could have shown that, yeah. And I  
3 can --

4 Q. And the R-squared value on the Inca  
5 station would be much closer to one than the  
6 R-squared on your black plot to the left; correct?

7 A. I doubt it -- I doubt it's very much --  
8 much closer, but it would be definitely an  
9 improvement.

10 Q. Okay. So let's go back to talking about  
11 running this on a log scale.

12 Would you agree that if you were to run  
13 this on a log scale, that would space out those data  
14 points in the lower left corner?

15 A. Yes, but it wouldn't make any difference  
16 on the R-squared.

17 Q. Okay. Do you agree that that's something  
18 commonly done in statistics when you see a  
19 clustering effect like this, you'll replot on a log  
20 scale?

21 A. In this case, I -- I want it to be an  
22 intuitively easy graph to understand. If I would  
23 have gone to the log scale, all those boundaries,  
24 1-to-1 line, and the -- the plus or minus  
25 40 percent, all of them would be curved and it would



1 have created, you know, some sort of additional  
2 confusing questions for some.

3 Q. Well, don't you agree that would also  
4 allow you to visually see the relationship between  
5 the measured and modeled data better than just  
6 looking at a clustered plot of dots?

7 A. It can easily be done and Mr. Sullivan  
8 should have done that, yes.

9 Q. But you chose not to do that.

10 A. I wanted to have a -- a graph which is  
11 as -- what is a good word? -- as less confusing as  
12 possible.

13 Q. And you think it's less confusing to have  
14 a cluster of dots where you can't see, visually, the  
15 relationship?

16 A. Especially when I put the R-squares and  
17 when I show 1-to-1 line there, and plus or minus  
18 40 percent, everything is well-defined and it is  
19 much easier to understand.

20 Q. Did you run -- well, strike that.

21 So this figure is looking at daily  
22 measured observations; correct?

23 A. Those measurements which are available  
24 every three days, yes.

25 Q. But it's not looking at monthly or annual

1 averages.

2 A. No. For that one, you need to go to  
3 Figure 1, which is the 3-month rolling -- maximum  
4 rolling average.

5 Q. Did you look at the long-term correlation  
6 between the modeled and the measured data, either on  
7 a monthly, or annual, or quarterly basis?

8 A. No. What I did was -- was the criteria  
9 that Mr. Sullivan has used, the 3-month maximum  
10 rolling average; and remember that I only have one  
11 year of data.

12 Q. Okay. But you looked at it on a daily  
13 basis not on a month or longer basis; right?

14 A. In this curve, I compared every predicted  
15 value to its corresponding measured value whenever  
16 available.

17 Q. Would you agree that if you were to do  
18 the same analysis on a monthly basis, you get better  
19 correlation?

20 A. I haven't done that but when I looked at  
21 the 3-month rolling average, which is the criteria  
22 that Mr. Sullivan is using, the results are as awful  
23 as these.

24 Q. Wouldn't you agree that anytime you would  
25 evaluate an air quality model by doing what you did

1 in Figure 2, taking a specific daily measurement at  
2 a specific location and comparing it to the modeled  
3 measurement at that location, your R-squared value  
4 is always going to be close to zero?

5 A. I don't believe so because remember that  
6 the sheer fact that we have these boundaries, a wide  
7 range of boundaries, that numbers could be  
8 substantially different, means that if the vast  
9 majority of your results are within there, then you  
10 still view the model as reliable, even when  
11 R-squared may not be close to one.

12 Q. But in your entire career, you've never  
13 taken an air quality model, matched the measured  
14 observations at a specific time and location on a  
15 daily basis to the modeled, and found good  
16 correlation, have you?

17 A. As I said, in the -- as you can see from  
18 this graph to the left, that there's a wide range of  
19 possibility. If the dots fall within that entire  
20 spectrum, we still view the model as being reliable.  
21 So there's a lot of leeway it has, but as you  
22 mentioned, air quality modeling is not a -- it's not  
23 as straightforward in your process. That's the  
24 reason that we're allowing up to plus or minus  
25 50 percent variations. And even within this highly

1 liberal arrangement, Mr. Sullivan's model failed.

2           And again, I will refer back to my  
3 Figure 1 and Table 5. Even on the basis of some  
4 sort of an annual measure that -- like, maximum  
5 3-month rolling average, still his model performs  
6 miserably.

7           MS. WILKINS: Move to strike as  
8 non-responsive.

9 QUESTIONS BY MS. WILKINS:

10       Q. My question is, in your entire career,  
11 the work you've done, the articles you've read, what  
12 you examined in this case, what you've examined at  
13 any point in your career, you cannot point to a  
14 single example of where an air quality model is  
15 evaluated by matching the measured data on a daily  
16 basis to the modeled data for that same time and  
17 location, and found good model performance; correct?

18           MR. WILL: Object to form. Asked and  
19 answered.

20           THE WITNESS: Yeah, I've already  
21 answered the question. Mr. Sullivan's model  
22 fails even on a nonconcurrent basis. And if  
23 you look at the EPA, at the 2017 document that  
24 we were discussing earlier today, it, in fact,  
25 cites to reports and identifies 10 to

1 40 percent being the typical margin of error  
2 when you do nonconcurrent comparisons. So --

3 MS. WILKINS: Object as  
4 non-responsive.

5 THE WITNESS: -- Mr. Sullivan's model  
6 fails miserably on every basis.

7 MS. WILKINS: Move to strike as  
8 entirely non-responsive.

9 QUESTIONS BY MS. WILKINS:

10 Q. When we get back from the lunch break,  
11 I'm going to ask you if you can cite a single  
12 article, a single source, that evaluated an air  
13 model by comparing it to measured data taken daily  
14 and found good performance. Tell me if you can find  
15 something, and I'm going --

16 MR. WILL: There's no question  
17 pending.

18 MS. WILKINS: -- to ask you again  
19 when we get back from lunch.

20 MR. WILL: And we're not agreeing for  
21 him to do any work between now and the end of  
22 the break, sorry.

23 QUESTIONS BY MS. WILKINS:

24 Q. Okay. Well, I'm just telling you, I'm  
25 going to ask you again when you get back from lunch,

1 and if you can't point me to one, I'm going to  
2 understand that you can't find one. It's not cited.  
3 You haven't --

4 MR. WILL: Well, you can understand  
5 whatever you want.

6 MS. WILKINS: Bob, you are  
7 interrupting me.

8 MR. WILL: He has no obligation --  
9 listen, he has no obligation to do any work  
10 during his lunch break, and we're not going to  
11 do it.

12 QUESTIONS BY MS. WILKINS:

13 Q. Okay. Well, I'm just advising, I'm going  
14 to ask this question again when we get back from  
15 lunch --

16 MR. WILL: Do what you want.

17 QUESTIONS BY MS. WILKINS:

18 Q. -- and if the answer is that you can't  
19 point me to one in your report, and you can't point  
20 me to one that you found since your report, then I  
21 will understand the answer to mean you don't have an  
22 example of where anyone has ever compared an air  
23 model in time and space by comparing a measured data  
24 from a daily reading to the model data for a daily  
25 reading and found good performance.

1 MR. WILL: Whatever you want to do.

2 MS. WILKINS: Thanks, Bob. Let's  
3 take a lunch break now.

4 THE VIDEOGRAPHER: Off the record at  
5 11:58.

6 (Short recess taken.)

7 THE VIDEOGRAPHER: We are back on the  
8 record at 12:47.

9 QUESTIONS BY MS. WILKINS:

10 Q. Okay. Dr. Rouhani, I'd like to go back  
11 to Exhibit 2, the 2017 EPA guidance. Do you have  
12 that in front of you still?

13 A. Yes.

14 Q. Okay. If you could go to page 5186 of  
15 the document, which is page 5 of the PDF, and let me  
16 know when you're there.

17 A. Okay. Yes.

18 Q. Okay. Did you review this section of the  
19 EPA guidance in your work on this case?

20 A. No.

21 Q. Okay. Well, if you would take a moment  
22 to review it for me, please, and particularly I am  
23 wanting to ask you about the column on the left side  
24 of that page. About halfway down in that first  
25 column, it states, We acknowledge the issues and

1 potential challenges associated with conducting  
2 field studies for use in model performance  
3 evaluations, especially during stable light wind  
4 conditions, given the potentially high degree of  
5 variability that may exist across the modeling  
6 domain and the increased potential for microscale  
7 influences on plume transport and dilution. This  
8 variability is one of the reasons we discourage  
9 placing too much weight on modeled versus predicted  
10 concentrations paired in space and time in model  
11 performance evaluations.

12 Do you see that section?

13 A. Yes.

14 Q. Okay. Do you agree that this section is  
15 not addressing model performance evaluations only in  
16 the context of a regulatory application?

17 A. This is -- the document says what it  
18 says, yes.

19 Q. Okay. So this portion of the document is  
20 referring both to regulatory applications as well as  
21 models that are intended to simulate historic  
22 contamination; right?

23 A. This is about -- I'm reading the  
24 beginning of the paragraph, and it's trying to  
25 address the public comments supported the adoption



1 of adjusted underline U star option in AERMET, with  
2 a few comments expressed concerns regarding the  
3 potential for the adjust -- ADJ\_U\* option, to  
4 underestimate ambient concentrations.

5 I believe that this is a comment directly  
6 in response to -- of the comments which were made  
7 about that particular model option, and I have not  
8 reviewed that one so I cannot opine on this  
9 statement.

10 Q. Well, after -- after it talks about  
11 AERMET, doesn't it go on to talk about different  
12 comments that commenters made? That some commenters  
13 also expressed concern regarding the appropriateness  
14 of field study databases used in the EPA model  
15 evaluations.

16 Do you see that?

17 A. Yes.

18 Q. Okay. And so it's not talking there  
19 about the concerns about options in AERMET; right?

20 A. I think that it still is about AERMET  
21 because it is specifically -- it was something that  
22 caused all these comments. There was something in  
23 the model, AERMET, the ADJ\_U\* option, that generated  
24 these comments and I have not reviewed it so I  
25 cannot opine anything about it today.

1 Q. Okay. So it's your opinion, then, that  
2 the statement here by the EPA that this variability  
3 is one of the reasons that we discourage placing too  
4 much weight on modeled versus predicted  
5 concentrations paired in time and space and modeled  
6 performance evaluations is not applicable to your  
7 work?

8 A. I have not reviewed this so I can not  
9 open -- opine one way or another.

10 Q. Okay. Well, I'd like you to take the  
11 time to review it as you need to and then tell me  
12 whether the statement that I just read is applicable  
13 to the work you did in this case.

14 A. I -- frankly, I need to know what ADJ\_U\*  
15 option in AERMET is, and I think it will take a lot  
16 longer than a few minutes to figure out what is  
17 that. So if you want, you know, I can read the  
18 paragraph and my answer will be that I need to  
19 review this model, the comments, and then I can  
20 opine about the significance of the statement, the  
21 response stated.

22 Q. Why didn't you review this section of the  
23 EPA guidance in preparation of your report?

24 A. I didn't see it. Nobody directed --  
25 nobody asked me to review every model that EPA has

1 generated. And frankly, the reason that I reviewed  
2 certain parts of this document was the fact that  
3 Mr. Sullivan had cited it. So I just wanted to  
4 understand those sections that he cited.

5 Q. So we talked before the break about  
6 whether you could point me to any literature that  
7 says it's appropriate to model or compare in time  
8 and space when evaluating model performance. You  
9 certainly recall talking about that; right?

10 A. Yes.

11 Q. Okay. And you haven't been able to  
12 identify any literature that finds good model  
13 performance when pairing in time and space; right?

14 MR. WILL: Object to form. Improper  
15 question.

16 THE WITNESS: In fact, I thought  
17 about your questions and I go back to my  
18 documents, both my original expert report, as  
19 well as this one. EPA clearly came up with  
20 the concepts of comparing measured versus  
21 observed values. They described it -- even in  
22 this document, they describe and put numbers  
23 like 10 to 40 percent being that.

24 So my understanding is that hundreds  
25 of models have been reviewed by EPA before

1       they reach conclusions of this nature. So --  
2       and so I think that rather than trying to  
3       reinvent the wheel, I basically assumed that  
4       the fact that EPA documents mention  
5       comparisons, mention even certain, you know,  
6       numeric criteria, tells me that these have  
7       been done, these such comparisons, maybe not  
8       published in a peer reviewed journal, but  
9       definitely reviewed by the regulatory agencies  
10      to reach that conclusion.

11                   And I just want to give you few  
12      examples if -- if you're interested.

13      QUESTIONS BY MS. WILKINS:

14      Q.       No, that doesn't answer my question at  
15      all. I was asking you about articles, not EPA  
16      guidance. So I'm not interested in the examples but  
17      I do want to ask you a follow-up question.

18                   On what basis are you concluding that the  
19      EPA reviewed hundreds of models to conclude that  
20      pairing in time and space is a -- an appropriate way  
21      to evaluate model performance?

22      A.       For example, let's start with the earlier  
23      EPA guidance documents. For example, in  
24      paragraph 18 of my supplemental report, the EPA  
25      1978, early on was saying that on Model

1 Validation/Calibration, Section 6, states that any  
2 application of an air quality model may have  
3 deficiencies which cause estimated concentrations to  
4 be in error. When practical to obtain a measure of  
5 confidence in the estimates, they should be compared  
6 with observed air quality and their validity  
7 determined.

8           Then, for example, one of the documents  
9 that Mr. Sullivan cited, this is an EPA 2002  
10 document. I'm reading the title for it. It's  
11 called Example Applications of Modeling Toxic Air  
12 Pollutants in Urban Areas. If you go to page 17 of  
13 this document, it says that -- and this is exactly  
14 the statement that Mr. Sullivan cited in his  
15 original expert report -- For model evaluation  
16 studies, a factor of two agreement between modeled  
17 and observed values is generally considered to be  
18 acceptable.

19           This is a 2008 document. So it tells me  
20 that EPA, through -- should have reviewed many  
21 such -- many such models to reach such clear  
22 criteria for -- such as the factor of two agreement,  
23 such as 10 to 40 percent is a reasonable number, you  
24 know. So it's a typical margin of error. I'm  
25 sorry, 10 to 40 percent is a typical margin of error

1 when you're comparing highest estimates.

2           So these basically gave me the impression  
3 that such comparison have been done and, as a  
4 result, people have come up with conclusions. And  
5 as I said, all those issues that you raised such as  
6 meteorological variability, emission variabilities,  
7 these are all the reasons that the EPA guidance  
8 document acknowledges you cannot match everything  
9 1-to-1; however, a reliable model must meet certain  
10 of these criteria, otherwise it is just a numeric  
11 artifact.

12       Q.     Okay. So let's talk about that certain  
13 numeric criteria that you keep coming back to.  
14 Let's look at Exhibit 2, the EPA 2017 document  
15 again, page 28 of the PDF, page 5209 of the  
16 document, Section 4.1e.

17           You've made numerous references during  
18 your testimony today as well as in your report to  
19 this 40 percent threshold; correct?

20       A.     Because it's on a different page of this  
21 document, and it was cited before, so I'm just  
22 reciting it.

23       Q.     Okay. So what I'm talking about is the  
24 40 percent threshold that you've referenced numerous  
25 times, that comes from Section 4.1e; correct?

1 A. Four point -- yes, correct.

2 Q. Okay. And what that document -- what the  
3 EPA is saying here is, Composite errors in highest  
4 estimated concentrations of 10 to 40 percent are  
5 found to be typical.

6 Did I read that correctly?

7 A. Yes.

8 Q. What do you understand highest estimated  
9 concentrations to mean within that statement?

10 A. Again, you need to go -- go back to the  
11 context of that section which is on page -- you  
12 probably know the PDF page better than I do -- 4.1e.

13 Q. Right. That's what we're reading from.  
14 It's PDF page 28.

15 A. Twenty-eight. Okay, thank you.

16 Okay. Here, if -- they talk about it  
17 here, and if you go to that -- to that -- the page  
18 that you just estimated, it basically recognizes  
19 that you may have large uncertainties. And it talks  
20 about errors of 5 to 10 degrees in the measured wind  
21 directions, 20 to 70 percent in particular time and  
22 location. And all these lead -- led them to the  
23 conclusion that the highest estimated concentration  
24 typically can vary between 10 to 40 percent  
25 difference between measured and observed.

1 Q. So my question was what do you understand  
2 highest estimated concentration to refer to?

3 A. It is, for example, if you have a period  
4 of time and your measurements, for example, your  
5 criteria is the 3-month rolling average for lead,  
6 then the maximum 3-month rolling average should --  
7 typically they should vary between 10 to 40 percent  
8 of the observed values.

9 Q. So in this sentence where the EPA is  
10 referring to the highest estimated concentration  
11 found within a model, it's talking about one point;  
12 right? The highest point; right?

13 A. I believe that -- again, this is my  
14 understanding -- that it all depends on the number,  
15 the one number, that you get out of your model. For  
16 example, in our case, the 3-month -- 3-month  
17 rolling -- maximum 3-month rolling average of lead  
18 would be one number. And that one number, when you  
19 compare that to its measured value, it says that  
20 typically should deviate no more than 10 to  
21 40 percent.

22 Q. Right. So let's kind of put some numbers  
23 on it. The EPA is saying that if you're modeling an  
24 emission source and the model says that the highest  
25 concentration should be 100, then what the EPA is



1 saying here is somewhere in your measured data you  
2 should expect to see a measurement between 60 and  
3 140.

4 Do you agree with that?

5 A. In other words, that -- let's be --  
6 since, you know, we're using specific examples,  
7 imagine you have one year of data, so you calculate  
8 the 3-month rolling averages of lead, so for every  
9 day you have a number, among those, you pick the  
10 highest ones. That will be your maximum 3-month  
11 rolling average. Then you have a similar set of  
12 numbers from your model and you calculate the same  
13 statistics, the maximum 3-month rolling average, and  
14 you put them together.

15 And remember that EPA says that these  
16 numbers may not be occurring at the same time. For  
17 example, Mr. Sullivan's models comes up with a  
18 3-month rolling average 9 months different from what  
19 the measured values showed, but we still compare  
20 those two numbers. And they -- according to the  
21 EPA, the typical deviations are between 10 to  
22 40 percent.

23 Q. Right. So do you agree with me that what  
24 the EPA is saying here as an example is if you  
25 model -- you model lead on a 3-month rolling average

1 from the La Oroya complex and just, hypothetically,  
2 the highest concentration that your model shows is  
3 100, do you agree, then, what the EPA is saying is  
4 that when you compare that to your measured data,  
5 you should see, somewhere in that data, a  
6 concentration between 60 and 140, or 40 percent from  
7 100.

8 Do you agree with that?

9 A. Again, you make -- you make statements  
10 which are not exactly correct. Your model is done  
11 on whatever basis that you're doing. For example,  
12 Mr. Sullivan was doing it on a daily basis for lead.  
13 Then he calculates the 3-month rolling averages for  
14 every single day and then he picks the highest one.  
15 So the model is daily but the statistics that he  
16 uses is the maximum 3-month rolling average.

17 And if -- if, for example, he gets -- he  
18 gets a number out of that, then EPA, in this  
19 particular document, says that, don't worry that --  
20 about doing it concurrently. So if you get a number  
21 like 100, measured values, your model typically  
22 should show something between 10 to 40 percent. So  
23 if you get 110, if you get 140, that's good, but if  
24 you're beyond that, or -- and also the opposite way,  
25 90, and then let's say it would be 60, if you're

1 outside of this, then you're outside of typical  
2 margins of error.

3 Q. And the EPA here is only talking about  
4 one point, the highest point; right? Not every  
5 point in the model?

6 A. Yes, this is -- this is nonconcurrent  
7 measurements, yes.

8 Q. Okay. So in your -- in your report, you  
9 compare every point within Mr. Sullivan's model to  
10 evaluate whether it falls within a 40 percent  
11 threshold of the measured data; right?

12 A. I -- I mean, for every station, he has  
13 estimated values based on his model. I calculate --  
14 for lead, I calculated 3 months rolling -- maximum  
15 rolling average, and I compare it to his  
16 corresponding measured value.

17 Q. But you're not just looking at the  
18 highest point within the model or within the  
19 measured data, you're looking at all of them;  
20 correct?

21 A. I'm doing it for every station.

22 Q. Okay. And the EPA, you would agree, is  
23 not advising where within the measured data you  
24 would see that highest point, just that you would  
25 expect to see it somewhere within the data; right?

1           A.       On that issue, for the regulatory cases,  
2 they are -- for regulatory applications, they are  
3 saying that given the fact that regulatory  
4 applications focus on hypothetical extreme future  
5 conditions, which you may not even have a  
6 representative data, then for those cases, you may  
7 not even go to the calibration.

8           Q.       Wouldn't you agree that what you've done  
9 in your report by looking at each station is not  
10 what the EPA is advising here because you're looking  
11 at seven different maximums, not one maximum.

12          A.       I am -- in fact, these are not  
13 recommendations, by the way. These are actual  
14 results of their review, of, I believe the models,  
15 and they, in fact, have two references, 32 and 33.  
16 So they have reviewed models and they are saying  
17 that typical margins of error should be 10 to 40,  
18 and I'm using that criteria.

19          Q.       Right, but wouldn't you agree that  
20 they're saying typical margins of error for one  
21 point, the highest point within the model, fall  
22 within 10 and 40?

23          A.       At this -- this text is not that  
24 specific. At least my understanding is that it's  
25 not -- and even the word "highest" is really --

1 depends on specific parameter statistics that you're  
2 using.

3 Q. What are you relying on for your --

4 A. Because, you know -- I'm sorry -- in  
5 natural language, for example, highest could be the  
6 highest number, you know, ever mentioned, but in  
7 this particular case, my understanding is that it is  
8 for specific statistics.

9 Q. What are you basing that understanding  
10 from?

11 A. Because this is the way that, for  
12 example, Mr. Sullivan has done his modeling. When  
13 he uses different statistics for different  
14 chemicals, clearly each chemical has its  
15 own appropriate average. Lead is the 3-month  
16 rolling average maximum, then arsenic is maximum,  
17 while you have the 99 percent of the highest daily  
18 value. So -- and for SO, of course, sulfur dioxide.

19 Q. But that's not what you're doing. You  
20 are not using different statistics for different  
21 chemicals. What you are doing is looking at the  
22 highest concentration at each station; correct? At  
23 seven different locations; correct?

24 A. No.

25 MR. WILL: Object. Mischaracterizes

1 his report.

2 THE WITNESS: No. As I've stated in  
3 my supplemental report, what I've done is  
4 that, if you go to paragraph 19, the last  
5 sentence of the report is, In this work,  
6 nonconcurrent comparisons use the maximum  
7 annual 3-month rolling average for lead, the  
8 annual average for arsenic, and the annual  
9 99th percentile of the daily 1-hour maximum  
10 for sulfur dioxide; consistent with  
11 Mr. Sullivan's approach which he explained in  
12 page 68 of his original expert report.

13 QUESTIONS BY MS. WILKINS:

14 Q. And let's just talk about Figure 1 of  
15 your report.

16 A. Sure.

17 Q. All right. In Figure 1 of your report --

18 A. And let me go to that one, please. Okay.  
19 I'm there.

20 Q. What are you plotting in Figure 1?

21 A. In Figure 1, what I'm doing is that I'm  
22 basically calculating for all the -- this is for  
23 lead. So every dot that you see, whether predicted  
24 or measurement, are maximum 3-month rolling average.  
25 And I'm comparing -- and Mr. Sullivan has three

1 models, model runs. One, I refer to it as  
2 Sullivan-Cheremisinoff, which I believe it is  
3 similar to his original model, then there is  
4 Sullivan-McVehil, the Sullivan model, but apparently  
5 he uses Mr. McVehil's emission treatment scenarios,  
6 and then finally his most recent emission scenario  
7 which we call Sullivan-Sullivan. And they're all  
8 represented there in -- and I've used different  
9 coloring so this way there will be no  
10 misunderstanding of these different results.

11 Q. And which data are you applying this  
12 40 percent threshold to?

13 A. All these are basically, as you can see,  
14 predicted versus measured, nonconcurrent, of a  
15 specific parameter that Mr. Sullivan is using for  
16 lead, is the maximum 3-month rolling average. I'm  
17 comparing those. And the red dashed lines are the  
18 plus or minus 40 percent boundaries. And as you can  
19 see that almost all of the predictions, regardless  
20 of the model, are outside of that domain.

21 Q. What I'm not understanding from your  
22 report is what -- where your measured data comes  
23 from. Is it from one measurement of the highest  
24 concentration within that data or more than one?

25 A. Okay, let's look at one of these squares.

1 I'm looking -- let's look at the -- at the blue  
2 square which is in the upper left corner. That  
3 is -- I have -- I've compared -- the predicted  
4 value, this is for Sindicato station. So I have  
5 used all these results that Mr. Sullivan has  
6 provided for Sullivan-McVehil model run for the  
7 entire year. And for Sindicato, I have calculated  
8 the maximum 3-month rolling average. And so that is  
9 my predicted value for that blue circle. The  
10 measured value, again, Mr. Sullivan has provided the  
11 measured values during that year. I've also  
12 calculated the 3-month max -- maximum 3 months  
13 rolling average at that station which happens to be  
14 Sindicato, and then I've plotted that first blue  
15 circle.

16 Q. Okay.

17 A. Then the red circle is for the same  
18 station but a different --

19 Q. Let's stop there. Let's talk about the  
20 blue square in the bottom right.

21 A. Yeah.

22 Q. Where does that data come from?

23 A. That comes from Huanchan.

24 Q. Okay. So --

25 A. Based on the model that Mr. Sullivan



1 refers to as having Dr. McVehil's emission  
2 treatments.

3 Q. Okay. So what you're doing in this  
4 figure is plotting the maximum 3-month rolling  
5 average for each station, modeled versus measured;  
6 right?

7 A. Yes.

8 Q. Okay. And wouldn't you agree that this  
9 statement that we've been reading from the EPA that  
10 talks about composite errors and highest estimated  
11 concentrations of 10 to 40 percent are found to be  
12 typical, doesn't tell you where -- a location where  
13 you would expect to find your highest measured  
14 concentration within your dataset?

15 A. It just simply says highest. And it is  
16 my understanding that -- again, this is my  
17 understanding, that they are referring to the  
18 comparison of the nonconcurrent statistics of --  
19 based on the results of the model.

20 Q. And you, then, disagree with an  
21 interpretation of this EPA document that would say  
22 you're only -- you're only supposed to look for  
23 concurrence between 10 to 40 percent of one highest  
24 maximum, not a highest maximum at seven different  
25 points within your data.

1           A.       This is the way that the model has been  
2 used. It was not -- it has not been presented as a  
3 uniform model for the entire investigated area. In  
4 fact, Mr. Sullivan has made a number of statements,  
5 based on his modeled results, regarding  
6 concentrations in La Oroya Antigua.

7                       So there are -- this model,  
8 Mr. Sullivan's model, is specifically aimed to come  
9 up with a spatial distribution of the results and  
10 therefore, again, it is my understanding that, given  
11 the purpose of this model, every station should be  
12 compared separately.

13          Q.       Are you relying on anything other than  
14 this 2017 EPA document for your understanding that  
15 every station should be compared separately?

16          A.       This is my understanding. Then I also  
17 rely on EPA 1978, the original guidance. And I also  
18 relied on the EPA 2002 guidance document, that,  
19 again, Mr. Sullivan has cited.

20          Q.       Okay. Anything else?

21          A.       These are the ones that Mr. Sullivan  
22 cited and I did my best to abide myself to the  
23 documents that he has cited.

24          Q.       So as we sit here, you're not aware of  
25 any other articles or literature that provides that

1 when you are looking for, you know, 10 to 40 percent  
2 agreement between modeled and measured, that you  
3 should look at data from multiple air monitoring  
4 sources?

5 A. Again, this is my understanding, and the  
6 fact that Mr. Sullivan very much present his model  
7 as a depiction of the geographical distribution of  
8 air contamination. Therefore, I think that a  
9 station-by-station comparison is most appropriate.

10 Q. While we've got this exhibit still in  
11 front of us, let me make sure I understand your  
12 testimony about Section 4.1. I understand your  
13 testimony to be that subsections a. through e. all  
14 address modeling for both regulatory purposes and to  
15 simulate historical contamination.

16 Do I have that correct?

17 A. It seems to be that based on the review,  
18 my understanding of the document.

19 Q. Okay. Then let me understand your  
20 opinion about Subsection f.

21 Is it your opinion that that entire  
22 subsection only relates to modeling for regulatory  
23 purposes?

24 A. This is the impression that I got after  
25 reading that paragraph.

1 Q. Okay. So let's look at the first  
2 sentence of Subsection f. that reads, Model  
3 evaluations and inter-comparisons --

4 A. Please allow me to open it up.

5 Okay. I have it in front of me.

6 Q. Okay. And do you -- do you have the  
7 correct page in front of you?

8 A. I have the page 28, PDF.

9 Q. Perfect. So in Subsection f., the first  
10 sentence reads, Model evaluations and  
11 inter-comparisons should take these aspects of  
12 uncertainty into account.

13 Do you see that?

14 A. Yes.

15 Q. What aspects of uncertainty do you  
16 understand the EPA to be referring to there?

17 A. That estimates of concentration pairing  
18 time and space with observed concentrations are less  
19 certain. In other words, that why 10 to 40 percent  
20 is for the highest, you know, my understanding of  
21 probative statistics, when you go to the locations,  
22 when you pair them in time and space, you even  
23 expect more variations. That's the reason that I  
24 used the 2008 EPA guidance, and for concurrent  
25 comparisons, I'm using plus or minus 50 percent,

1 which is much wider than 10 to 40.

2 Q. Okay. So specific to the EPA's reference  
3 to aspects of uncertainty within models, I  
4 understand that to mean the things that the EPA is  
5 referring to in section -- or Subsection e. where it  
6 discusses irreducible and reducible certainty --  
7 uncertainty, excuse me -- to be things like wind  
8 speed, wind direction. Is that your understanding  
9 or not?

10 A. It basically means that -- that -- again,  
11 my understanding is that when you compare the  
12 highest estimated values, you should be able to  
13 manage those of the observed values better than when  
14 you compare specific times and locations.

15 MS. WILKINS: Move to strike as  
16 non-responsive.

17 QUESTIONS BY MS. WILKINS:

18 Q. Dr. Rouhani, what I'm trying to talk to  
19 you about is how you interpret the term "aspects of  
20 uncertainty;" okay? And so what I'm asking you is,  
21 do you understand that term "aspects of uncertainty"  
22 to mean things like are referenced in Subsection c.;  
23 for example, changes in meteorology that are likely  
24 to occur during trial time, or things like wind  
25 speed and wind direction. Is that your

1 understanding of that statement or not?

2 A. My -- my understanding is different.

3 Q. Okay. And so, then, you interpret that  
4 first line of Subsection f. only to refer to models  
5 that are used for regulatory applications; correct?

6 A. The first sentence is an introductory  
7 first sentence. Model evaluations and  
8 inter-comparisons should take those aspects of  
9 uncertainty into account. So this is the first  
10 sentence, which I believe refers to the fact that if  
11 you look at particular statistics, such as an  
12 average, like arsenic annual average, you will get  
13 better fit than if you compare it to a daily  
14 measurement. Understanding this, then it says that  
15 for a regulatory application of a model, the  
16 emphasis of model evaluation is generally placed on  
17 the highest modeled impacts. In other words, for  
18 regulatory conditions, we're looking at the  
19 hypothetical extreme conditions in the future, we  
20 are really keen about the highest numbers, what they  
21 call highest, or, as you mentioned, as you -- in one  
22 of the exhibits, Exhibit No. 3, you showed that the  
23 National Ambient -- Air Ambient Quality, this  
24 number, these statistics vary.

25 But they're saying that on a regulatory

1 basis, our focus is on those highest numbers;  
2 therefore, they claim that wind -- especially you're  
3 talking about hypothetical extreme conditions in the  
4 future, calibration may not be -- may not be  
5 beneficial. But it's -- so the rest of this  
6 paragraph is for regulatory application. Again,  
7 this is my understanding.

8 Q. So you agree, then, that the EPA says you  
9 should not expect accuracy within 40 percent if you  
10 are pairing in space and time; correct?

11 MR. WILL: Object to form.

12 THE WITNESS: No, it's -- it's saying  
13 that -- it says what it says, that it will be  
14 even less certain, i.e., more variations. In  
15 the 2008 --

16 QUESTIONS BY MS. WILKINS:

17 Q. i.e., greater --

18 A. EPA 2008 guidance document identifies  
19 that at plus or minus factor of 2.

20 Q. Okay. So that would mean 50 percent;  
21 right?

22 A. Yes.

23 Q. Okay. This document, or indeed any EPA  
24 document that you've referenced, they don't say that  
25 modeling is considered unreliable unless multiple

1 points within the model fall within a 40 percent  
2 value when you compare modeled versus measured;  
3 correct?

4 MR. WILL: Object to form. Broad --  
5 over -- overbroad and vague.

6 THE WITNESS: I'm -- I really can't  
7 answer your question because it's so broad  
8 and --

9 QUESTIONS BY MS. WILKINS:

10 Q. Okay. So in any of the EPA documents  
11 that you've referenced, do they say -- does the EPA  
12 say that if you are -- if you are doing an air  
13 quality model, that the model is unreliable unless  
14 more than one point within the model falls within  
15 40 percent of the corresponding measured data?

16 MR. WILL: Object to form.

17 THE WITNESS: Again, the purpose of  
18 the model is very important. If your  
19 objective is to display the geographical  
20 distribution of air contamination, then every  
21 monitoring point is -- is a location that you  
22 need to assess. For some locations, you may  
23 say, Hey, I have a model that is reasonable;  
24 where the other ones you can say, Oh, they're  
25 highly unreliable, grossly underestimating or



1 overestimating.

2 QUESTIONS BY MS. WILKINS:

3 Q. All right. So we talked about literature  
4 that addresses pairing in time and space as far as  
5 whether it should be done but have you encountered  
6 any literature that says that pairing in time and  
7 space should not be done when evaluating model  
8 performance in a situation like this where the model  
9 addresses or simulates historical contamination?

10 A. I have not seen any document to that  
11 effect.

12 Q. Did you look for any?

13 A. I mean, I relied primarily on the EPA  
14 guidance documents that Mr. Sullivan had cited, and  
15 none of them said anything as such.

16 Q. And Mr. Sullivan doesn't evaluate his  
17 model by comparing -- or pairing in time and space;  
18 right?

19 A. Mr. Sullivan does certain things but it's  
20 very incoherent and -- and he always -- he prefers  
21 to what I call qualitative statements.

22 MS. WILKINS: Move to strike as  
23 non-responsive.

24 QUESTIONS BY MS. WILKINS:

25 Q. Did Mr. Sullivan evaluate his own model

1 by pairing in time and space?

2 A. He -- if you look at his model results,  
3 there are tables that have observed versus measured,  
4 and -- but I don't know how far he has gone to  
5 evaluate them.

6 In his original model, he -- I'm sorry,  
7 in his original expert report 2019, he included even  
8 some regression analyses for certain modeled results  
9 versus observed results.

10 (Deposition Exhibit 4 marked  
11 for identification.)

12 QUESTIONS BY MS. WILKINS:

13 Q. Okay. I just dropped in the Chat panel  
14 two documents, you can disregard the first one  
15 because I -- it doesn't have the exhibit sticker on  
16 it, and open up the second. The file name starts  
17 with Exhibit 4?

18 A. Sure.

19 Q. When you've had an opportunity to open  
20 that and look at that, would you tell me whether  
21 this is an article that you've ever seen before?

22 A. No, I have not seen this one.

23 Q. Okay. Are you familiar with this  
24 publication, Meteorology and Atmospheric Physics?

25 A. I've heard about it.

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1 Q. Do you consider it to be an authoritative  
2 source?

3 A. I don't know.

4 Q. Have you ever used the source Meteorology  
5 and Atmospheric Physics in your work?

6 A. I may have. I don't recall it at this  
7 moment.

8 Q. Okay. Are you familiar with these  
9 authors, J. C. Chang and S. R. Hanna?

10 A. They are -- they appear to be associated  
11 with George Mason University in Fairfax, Virginia.  
12 No, I'm not familiar with them.

13 Q. Okay. Are you familiar with the School  
14 of Computational Sciences at George Mason  
15 University?

16 A. No.

17 Q. Do you understand this article to have  
18 been peer reviewed?

19 A. It seems like it, yes.

20 Q. So if you want to take a moment to look  
21 at this article and tell me whether you agree that  
22 it's addressing not just air modeling used for  
23 regulatory applications, but also air modeling used  
24 for historic simulation?

25 A. Sure.

1 Q. Okay. And if you would look at --

2 A. I'm reading the abstract -- the summary,  
3 I'm sorry.

4 Q. Oh, sure.

5 A. I've finished reading the summary.

6 Q. Okay. Would you agree that this article  
7 addresses air quality modeling for both regulatory  
8 purposes and for historic simulation?

9 A. From this summary, it seems that it's  
10 just a generic model.

11 Q. Okay. I'd like you to go to page 19 of  
12 the PDF. And do you see Table 1 there?

13 A. Yes.

14 Q. Okay. Do you see right above Table 1  
15 where it states, Similar conclusions are found in  
16 the review paper by Weil, et al., 1992, on air  
17 quality model evaluation?

18 A. I'm looking at Table 1.

19 Q. Okay. Right above Table 1 --

20 A. Oh, right above; okay.

21 Q. It says, Similar conclusions are found in  
22 the review paper by Weil, et al., 1992, on air  
23 quality model evaluation.

24 Do you see that?

25 A. Yes.

1 Q. All right. Are you familiar with Weil,  
2 et al., 1992?

3 A. Yes.

4 Q. Okay. Did you review that for your work  
5 in this case?

6 A. No.

7 Q. Why are you familiar with it?

8 A. Oh, I'm sorry, I'm sorry, I misstated.  
9 I'm not familiar with the Weil, et al., article or  
10 whatever it is.

11 Q. Okay. Other than the EPA guidance, is it  
12 correct that you did not review any articles or  
13 other sources that addressed evaluation of air  
14 quality models?

15 A. I basically reviewed Mr. Sullivan's  
16 report. He cited specific EPA guidance documents  
17 and I basically relied on those in order to make my  
18 review of Mr. Sullivan's model as unbiased as  
19 possible.

20 Q. Okay. And I want to make sure I  
21 understand, also, that evaluation of air quality  
22 models is not a typical thing that you do within  
23 your work; right?

24 A. Yes.

25 Q. Okay. And the only other times that

1 you've ever evaluated performance of air quality  
2 models was once about 25 years ago, and then  
3 possibly again in the '90s?

4 A. Yes, and then a series of confidential  
5 studies.

6 Q. Well, in those series of confidential  
7 studies, did you evaluate air quality model  
8 performance?

9 A. I basically evaluated their reliability.

10 Q. And that was two or three occasions?

11 A. I would say half a dozen.

12 Q. And when was that?

13 A. These were scattered around the last 6 to  
14 7 years.

15 Q. When was the most recent one?

16 A. I will say it was last year.

17 Q. And when you did those -- work in those  
18 half a dozen cases, did you review any guidance  
19 sources other than EPA documents to advise you on  
20 the appropriate way to evaluate air quality models?

21 A. I -- as I said, in this case, I've cited  
22 all the guidance documents that I've referenced, and  
23 these are basically references that Mr. Sullivan  
24 used in his work.

25 Q. I'm not talking about this case. I'm

1 talking about those other six or so cases you said  
2 you have --

3 A. Those are confidential. Those are  
4 confidential. We looked at a variety of --

5 Q. I'm not asking you about the details of  
6 those cases. I need you to listen to the question  
7 that I'm asking you.

8 What I'm asking you is in those six or so  
9 cases, did you review any guidance sources, other  
10 than the EPA documents, to advise you on the  
11 appropriate way to evaluate air quality models?

12 A. Right now, I can only -- I only remember  
13 the EPA guidance documents.

14 Q. Okay. So we go on in this article by  
15 Chang and Hanna, they write that, They -- meaning  
16 Weil, et al. -- stress that, because of variations  
17 in wind direction, it is almost fruitless to attempt  
18 to compare predictions and observations paired in  
19 space and time.

20 Do you see that?

21 A. Yes.

22 Q. And do you agree here that we're not just  
23 talking about regulatory applications? We are  
24 talking about all kinds of applications of air  
25 modeling.

1           A.       The document says what it says. I don't  
2 know whether they have included the models that  
3 Mr. Sullivan has used. And they may or they may  
4 have not, but their statements are clearly stated  
5 there. From their point of view, are fruitless,  
6 then it's a very negative thing that basically says  
7 that, you know, expecting a reliable air model  
8 appears to be, to these authors, a fruitless goal.

9           Q.       I'd like to talk about the section of  
10 your report where you state your opinion that  
11 Mr. Sullivan misrepresented Dr. McVehil's modeling  
12 results. Can you explain what it is that you  
13 believe he misrepresented?

14          A.       When you read Mr. Sullivan's rebuttal, as  
15 well as his supplemental report, he repeatedly, and  
16 especially in his rebuttal, reminds the reader that  
17 the Defendant's experts consider Dr. McVehil's  
18 reports as being reliable. And then he, both in  
19 rebuttal as well as in his supplemental, he has  
20 columns, or statements, or files that he calls  
21 McVehil, and that supposedly are his model, are  
22 Mr. Sullivan's model, but using the emission  
23 treatment -- emission treatments that Dr. McVehil  
24 has used.

25                   When you compare the results, you see



1 that -- that there is a vast difference between what  
2 Dr. McVehil reports versus what Mr. Sullivan  
3 presents as McVehil results, and I just wanted to  
4 highlight that that's a misrepresentation.

5 Q. Do you understand the reasons that  
6 Mr. Sullivan's numbers are different than  
7 Mr. McVehil's -- or Dr. McVehil's?

8 A. No. But when you're reproducing  
9 somebody's model, you either say that -- you know,  
10 you need to come up with fairly close numbers.

11 Q. Did you read Mr. Sullivan's full report?

12 A. I -- oh, sure. Yes.

13 Q. Okay. So you don't understand, after  
14 reading his report, that one of the changes he made  
15 when he re-ran Mr. -- or Dr. McVehil's model was to  
16 remove that massive imaginary building?

17 A. I presumed that that was only for -- it  
18 was not for SO<sub>2</sub>, for sulfur dioxide, it was only for  
19 lead, I believe. And we tried to make sure that we  
20 used both with buildings and without buildings  
21 because he -- Mr. Sullivan allegedly ran both.

22 Q. And are you critical of Mr. Sullivan for  
23 running Dr. McVehil's model without that big  
24 imaginary building?

25 A. I have not been asked to comment on it

1 and I have no opinion.

2 Q. All right. And on the flip side of that,  
3 do you have an opinion on whether Mr. Sullivan  
4 should have included a fake building 35 times bigger  
5 than any other building on earth in his model?

6 A. I'm not an air modeler, so I don't know  
7 what his purpose was.

8 Q. Are you aware that the other difference  
9 between Mr. Sullivan's input and Mr. McVehil's is  
10 the meteorological data that was used?

11 A. I don't know.

12 Q. Okay.

13 A. I was not asked to review that aspect.

14 Q. Okay. So if I represent to you that  
15 Dr. McVehil's meteorological data was not available  
16 to Mr. Sullivan, and therefore Mr. Sullivan used WRF  
17 files instead of what Dr. McVehil used, you don't  
18 have an opinion on whether that was appropriate or  
19 not?

20 A. I'm -- I did not study that issue.

21 Q. Did you review the report from Doe Run's  
22 consultant, Exponent, that addressed Dr. McVehil's  
23 model?

24 A. I looked at certain parts of it but not  
25 the whole entire report.

1 Q. Did you understand that Exponent  
2 criticized Dr. McVehil's use -- Dr. McVehil's use of  
3 unreliable meteorological data?

4 A. I don't know.

5 Q. Are you aware that part of the  
6 meteorological data that Dr. McVehil used was  
7 actually from a totally different location, not in  
8 La Oroya?

9 A. I don't know.

10 Q. Do you know that Mr. Sullivan used Mr. --  
11 or Dr. McVehil's exact emission rates when he ran  
12 the comparison?

13 A. I don't know.

14 Q. Do you know that Mr. Sullivan used  
15 Dr. McVehil's exact release specifications, other  
16 than the imaginary building, when he ran the  
17 comparison?

18 A. I don't know.

19 Q. Okay. So when you say that Mr. Sullivan  
20 misrepresented Dr. McVehil's model, all you're  
21 talking about is that the numbers Dr. McVehil  
22 reported are not the same as the numbers that  
23 Mr. Sullivan reported; right?

24 A. Yes.

25 MS. WILKINS: Okay. I don't have any

1 additional questions right now. I want to  
2 take a moment just to review.

3 Bob, you can either, you know,  
4 continue and we can take a break later, or we  
5 can take a break now.

6 MR. WILL: We can take a break now if  
7 you want.

8 MS. WILKINS: Okay. Let's just pause  
9 for a minute -- let's see. Five minutes  
10 should be sufficient.

11 MR. WILL: Okay.

12 THE WITNESS: Okay. Thank you.

13 THE VIDEOGRAPHER: Off the record at  
14 1:47.

15 (Short recess taken.)

16 THE VIDEOGRAPHER: Back on the record  
17 at 1:56.

18 MS. WILKINS: Okay. Dr. Rouhani,  
19 thank you for your time. I have no further  
20 questions.

21 THE WITNESS: Thank you very much,  
22 Beth.

23 MR. WILL: I have no questions.  
24 We'll read and sign.

25 THE WITNESS: Thank you very much and

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1     have a lovely day.

2                   MS. WILKINS:   You, too.

3                   THE VIDEOGRAPHER:   This will conclude  
4     the deposition of Dr. Shahrokh Rouhani.   We  
5     are off the record at 1:56.

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Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021  
A.O.A., et al. vs DOE RUN RESOURCES CORPORATION, et al.,

1 STATE OF MISSOURI.

2 SS.

3 COUNTY OF ST. LOUIS

4 I, Gretta G. Cairatti, RPR, CRR, MO-CCR  
5 #790, IL-CSR #084-003418, in and for the State of  
6 Missouri, duly qualified and authorized to  
7 administer oaths and to certify to depositions, do  
8 hereby certify that pursuant to notice in the civil  
9 cause now pending and undetermined in the United  
10 States District Court for the Eastern District of  
11 Missouri, Eastern Division, to be used in the trial  
12 of said cause in said court, I was attended by Zoom  
13 videoconference, by the aforesaid witness; and by  
14 the aforesaid attorneys; on the 14th day of  
15 April, 2021.


16 That the said witness, being of sound  
17 mind and being by me first carefully examined and  
18 duly cautioned and sworn to testify the truth, the  
19 whole truth, and nothing but the truth in the case  
20 aforesaid, thereupon testified as is shown in the  
21 foregoing transcript, said testimony being by me  
22 reported in shorthand and caused to be transcribed  
23 into typewriting, and that the foregoing pages  
24 correctly set forth the testimony of the  
25 aforementioned witness, together with the questions

Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021  
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1 propounded by counsel and remarks and objections of  
2 counsel thereto, and is in all respects a full,  
3 true, correct and complete transcript of the  
4 questions propounded to and the answers given by  
5 said witness; that signature of the deponent was  
6 reserved by agreement of counsel.

7 I further certify that I am not of  
8 counsel or attorney for either of the parties to  
9 said suit, not related to nor interested in any of  
10 the parties or their attorneys.

11 Witness my hand at St. Louis, Missouri,  
12 this 19th day of April, 2021.

13  
14   
15 \_ \_ \_ \_ \_

16 Certified Court Reporter in and for the  
17 State of Missouri  
18  
19  
20  
21  
22  
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24  
25

Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021  
A.O.A., et al. vs DOE RUN RESOURCES CORPORATION, et al.,

1 360 Litigation Services

2 Monday, April 19, 2021

3 Robert Will, Esq.

4 Lewis Rice LLC

5 600 Washington Avenue, Suite 2500

6 St. Louis, MO 63102-2147

7 Re: Deposition of SHAHROKH ROUHANI, Ph.D., PE  
Date: April 14, 2021

8 Case: A.O.A., et al. vs. DOE RUN RESOURCES  
CORPORATION, et al.

9

10 Robert Will, Esq.,

11 Your witness did not waive the right to read and  
12 sign his/her deposition in the above referenced  
13 matter. Enclosed is the copy of the deposition you  
14 ordered, together with errata sheets and additional  
15 signature page. Please instruct your witness to  
16 read the transcript, list any corrections (including  
17 page and line number) on the errata sheets, sign and  
18 date the errata sheets and signature page.

19 Within 30 days, please return the errata sheets and  
20 signature page to our office for further processing.  
21 Your prompt cooperation will be appreciated.

22

23

Sincerely,

24

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25

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**EXHIBIT 2**

A.O.A., et al. vs DOE RUN RESOURCES CORPORATION , et al.,

[illegible]

Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021  
A.O.A., et al. vs DOE RUN RESOURCES CORPORATION, et al.,

1 Comes now the witness, SHAHROKH  
2 ROUHANI, Ph.D., PE, and having read the  
3 foregoing transcript of the deposition taken  
4 on April 14, 2021, acknowledges by signature  
5 hereto that it is a true and accurate  
6 transcript of the testimony given on the date  
7 hereinabove mentioned.

8

9

10

11

12

13 \_\_\_\_\_  
14 SHAHROKH ROUHANI, Ph.D., PE

15

16

17

18 Subscribed and sworn to me before this \_\_\_\_\_

19 day of \_\_\_\_\_, 2020.

20

21 My Commission expires:

22

23

24

25 \_\_\_\_\_  
Notary Public.

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